UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SEG MANUFACTURING INC., NEW ENERGY IMPORTS INC., SEG SOLAR INC., PT. SEG SOLAR MANUFAKTUR INDONESIA, and SEG ENERGY SINGAPORE PTE. LTD.

Petitioners

v.

SHANGHAI JINKO GREEN ENERGY ENTERPRISE MANAGEMENT CO., LTD. and ZHEJIANG JINKO SOLAR CO., LTD.,

Patent Owner

Case No. IPR2026-00230
Patent 11,824,136

PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 11,824,136

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d) Claim 1[c]: "wherein a front surface of the semiconductor substrate has a second texture

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Exhibit #	Description
EX1001	U.S. Patent No. 11,824,136 to Yu et al. ("the '136 Patent")
EX1002	CV of Petitioners' Expert Dr. Fred Shubert
EX1003	Expert Declaration of Petitioners' Expert Dr. Fred Shubert
EX1004	Chinese Patent No. CN112259614A to Ye et al. ("*Ye*")
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EX1012	Basu, P.K. et al. (2015), The effect of front pyramid heights on the efficiency of homogeneously textured inline-diffused screen-printed monocrystalline silicon wafer solar cells, *Renewable Energy,* 78, (590-598). http://dx.doi.org/10.1016/j.renene.2015.01.058 ("Basu Paper")
EX1013	Guan, L. et al. (2019), Double-sided pyramid texturing design to reduce the light escape of ultrathin crystalline silicon solar cells, *Optics and Laser Technology,* 120, (1-7). https://doi.org/10.1016/j.optlastec.2019.105700 ("Guan Paper")
EX1014	Lozach M. et al. (2020), Role of silicon surface polished <100> and <111> or textured on the efficiency of double-sided TOPCon solar cells, *Progress in Photovoltaics* 28, (1001-1011).

	https://onlinelibrary.wiley.com/doi/abs/10.1002/pip.3304 ("Lozach Book")
EX1015	Arvind Shah, Solar Cells and Modules, Spring Series in Materials Science Vol. 301 (2020) ("Shah Book")
EX1016	Yu, et al. (2021). Selective tunnel oxide passivated contact on the emitter of large-size N-type TOPCon bifacial solar cells. *Journal of Alloys and Compounds*, 870, 159679-686. ("Yu Paper")
EX1017	Chinese Patent No. CN113193074A to Du et al. ("Du")
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EX1022	U.S. Patent No. US20180277701A1 to Lenes et al. ("Lenes")
EX1023	U.S. Patent No. US11456391B2 to Chang et at. ("Chang")
EX1024	Kim, Y., Lee, H., & Park, J. (2008). Texturing of large area multi-crystalline silicon wafers through different chemical approaches for solar cell fabrication. *Solar Energy Materials & Solar Cells,* 92(9), 960-964. ("Kim-1 Paper")
EX1025	Papet, P., et al. (2006). Pyramidal texturing of silicon solar cell with TMAH chemical anisotropic etching. *Solar Energy Materials and Solar Cells*, 90, 2319-2325. ("Papet Paper").
EX1026	Kim, H., et al. "Effect of Surface Treatment by Chemical-Mechanical Polishing for Transparent Electrode of Perovskite Solar Cells." *Energies*, vol. 13, no. 585, 2020. ("Kim-2 Paper")
EX1027	Le, Jianbo, et al. "Mechanisms of Surface and Subsurface Damage of Silicon Wafers Induced by External Stress During Nano-Polishing" *Ceramics International*, 2025. ("Le Paper")
EX1028	Li, Yiwei, et al. "The Effect of Chemical Polishing Treatment on the

	Microstructure and Photoelectric Properties of CdZnTe Polycrystalline Films." 2021. (“Li Paper”)
EX1029	Chinese Patent No. CN109802007B to Zeng et al. (“Zeng”)
EX1030	K. A.W. Horowitz et al., *A Techno-Economic Analysis and Cost Reduction Roadmap for III-V Solar Cells*, NREL/TP-6A20-72103 (Nat'l Renewable Energy Lab'y, Nov. 2018) (“Horowitz Report”)
EX1031	B. G. Priyadarshini et al., *Design of Multi-Layer Anti-Reflection Coating for Terrestrial Solar Panel Glass*, 39 Bull. Mater. Sci. 683 (June 2016) (Priyadarshini Paper)
EX1032	J.-Q. Xi et al., *Optical Thin-Film Materials with Low Refractive Index for Broadband Elimination of Fresnel Reflection*, 1 Nature Photonics 176 (Mar. 1, 2007) (“Xi Paper”)
EX1033	Panadyne, *Silicon Nitride Technical Data* (2026), https://panadyne.com/silicon-nitride-technical-data/.
EX1034	U.S. Patent Publication No. 20200212242A1 to Fang et al. (“Fang”)
EX1035	Richter, et al (2017). n-Type Si solar cells with passivating electron contact: Identifying sources for efficiency limitations by wafer thickness and resistivity variation. *Solar Energy Materials and Solar Cells*, *173*, 96-105. (“Richter”)
EX1036	Chinese Patent No. 111640824_MT to Shen et at., (from Orbit) (“Shen”)
EX1037	T. S. Eriksson et al., *Infrared optical properties of evaporated alumina films*, 20 Appl. Opt. 2742 (1981). (“Ericksson Paper”)
EX1038	F. Rebib et al., *Determination of Optical Properties of a-SiOxNy Thin Films by Ellipsometric and UV-Visible Spectroscopies*, 100 J. Physics: Conf. Series 082033 (2008). (“Rebib Paper”)
EX1039	U.S. Patent No. 11437529 to Li et al. (“Li”)
EX1040	Xie et al., *High Efficiency Chemical Mechanical Polishing for Silicon Wafers Using a Developed Slurry*, 38 Surfaces & Interfaces

	102833 (2023) (“Xie Paper”)

I. MANDATORY NOTICES UNDER 37 C.F.R. §42.8(A)(1)

A. Real Parties-in-Interest under 37 C.F.R. §42.8(b)(1)

The real parties-in-interest in this *inter partes* review ("IPR") are SEG Manufacturing Inc.; New Energy Imports Inc.; PT. SEG Solar Manufaktur Indonesia; SEG Energy Singapore Pte. Ltd.; and SEG Solar, Inc. The real parties-in-interest further may include one or more of the following entities: SEG Solar Jiangsu Co. Ltd.; Sunnexus Singapore Pte. Ltd.; SEG Holdings Inc.; SEG Land Holdings LLC; SEG Iberia SL; and Jun Zhuge (a natural person). No other parties exercised or could have exercised control over this Petition; no other parties funded or directed this Petition. *See* Office Patent Trial Practice Guide, 77 Fed. Reg. 48759-60.

B. Related Matters under 37 C.F.R. §42.8(b)(2)

Shanghai Jinko Green Energy Enterprise Management Co., Ltd. and Zhejiang Jinko Solar Co., Ltd. ("Patent Owner") have asserted U.S. Patent No. 11,824,136 (the "'136 Patent") against Petitioners in a co-pending litigation, *Shanghai Jinko Green Energy Enterprise Management Co., Ltd. and Zhejiang Jinko Solar Co., Ltd. v. SEG Solar, Inc., PT. SEG Solar Manufaktur Indonesia, SEG Energy Singapore Pte. Ltd., New Energy Imports Inc., SEG Manufacturing Inc., and SEG Solar Jiangsu Co. Ltd.*, Case No. 25-cv-5226 (S.D. TX. Oct. 31, 2025).

C. Lead and Back-Up Counsel Under 37 C.F.R. §42.8(b)(3)

Petitioners provide the following designation of counsel.

LEAD COUNSEL	BACK-UP COUNSEL
Elizabeth D. Flannery USPTO Reg. No. 59,509 **BAKER BOTTS L.L.P.** 910 Louisiana Street Houston, TX 77002 Phone: (713) 229-2104 Fax: (713) 229-7704 liz.flannery@bakerbotts.com	Douglas M. Kubehl USPTO Reg. No. 41,915 **BAKER BOTTS L.L.P.** 2001 Ross Avenue, Suite 900 Dallas, TX 75201-2980 Phone: (214) 953-6486 Fax: (214) 661-4486 doug.kubehl@bakerbotts.com Chad C. Walters USPTO Reg. No. 48,022 **BAKER BOTTS L.L.P.** 2001 Ross Avenue, Suite 900 Dallas, TX 75201-2980 Phone: (214) 953-6511 Fax: (214) 661-4511 Chad.walters@bakerbotts.com

D. Service Information under 37 C.F.R. §42.8(b)(4)

A copy of this entire Petition, including all Exhibits, are being served by FEDERAL EXPRESS, costs prepaid, to the address of the attorney or agent of record at the USPTO:

NIXON PEABODY, LLP, ATTN: EISENSTEIN, RONALD, 799 NINTH STREET, NW, SUITE 500, WASHINGTON, DC 20001, UNITED STATES

The same is also being served electronically to litigation counsel at the following address:

FOLEY & LARDNER LLP, 11988 EL CAMINO REAL, SUITE

400, SAN DIEGO, CA 92130

ray.wu@foley.com

mlaurence@foley.com

foleyinternaljinkoseg@foley.com

Petitioners consent to electronic service at DLSEGSolarShanghaiJinko@BakerBotts.com. A Power of Attorney is filed concurrently herewith under 37 C.F.R. § 42.10(b).

II. FEES

The Office is authorized to charge any fees that become due to Deposit Account No. 02-0384.

III. 37 C.F.R. §42.104 REQUIREMENTS

A. Certification of Grounds for Standing

Petitioners certify that the '136 Patent is eligible for IPR and that Petitioners are not barred or estopped from requesting IPR of the '136 Patent.

B. Priority Date

The application that issued as the '136 Patent was filed on October 12, 2022 as a divisional of Application No. 17/459,689, filed on August 27, 2021, which claims priority to a Chinese Patent Application No. 20211089225.8, filed August 4, 2021. Petitioners assume for purposes of this Petition, without conceding, that the '136 Patent is entitled to a priority date of August 4, 2021.

C. Prior Art[1]

Exhibit 1004—Chinese Patent No. CN112259614A to *Ye* et al. ("*Ye"*) was filed July 3, 2019, and published January 22, 2021. *Ye* qualifies as prior art under at least 35 U.S.C. §102(a)(1).

Exhibit 1005—Chinese Patent No. CN105826411B to *Yun* et al. ("*Yun"*) was filed May 17, 2016, and published December 08, 2017. *Yun* qualifies as prior art under at least 35 U.S.C. §102(a)(1).

Exhibit 1006—Chinese Patent No. CN111690987A to *Xia* et al. ("*Xia*") was filed July 19, 2020, and published September 22, 2020. *Xia* qualifies as prior art under at least 35 U.S.C. §102(a)(1).

Exhibit 1009—PCT International Publication No. WO2016/129481 to Sakai ("*Sakai*") was filed February 3, 2016 and published August 18, 2016. *Sakai* qualifies as prior art under at least 35 U.S.C. §§102(a)(1) and (2).

Exhibit 1012—Basu, P.K. *et al.*, "The effect of front pyramid heights on the efficiency of homogeneously textured inline-diffused screen-printed monocrystalline silicon wafer solar cells" *Renewable Energy,* 78, (590-598),

[1] Original references for EX1004, EX1005, EX1006 and EX1009 are in Chinese or Japanese; Certified English translations are appended thereto, and citations are to the paragraphs/figures of the English translations.

("*Basu*") was published February 11, 2015. *Basu* qualifies as prior art under at least 35 U.S.C. §102(a)(1). EX1020 ¶¶46-52, 80.

Exhibit 1023—U.S. Patent No. US11456391B2 to *Chang* et al. ("*Chang*") was filed June 28, 2019, and published on September 27, 2022. *Chang* qualifies as prior art under at least 35 U.S.C. §§102(a)(1) and (2).

Exhibit 1016—Yu, Bo *et al.*, "Selective tunnel oxide passivated contact on the emitter of large-size n-type TOPCon bifacial solar cells," *Journal of Alloys and Compounds* 870, 159679-686 ("*Yu*") was published March 27, 2021. *Yu* qualifies as prior art under at least 35 U.S.C. §102(a)(1). EX1020, ¶¶73-80.

Exhibit 1034— U.S. Patent Application Publication No. 2020/0212242 by *Fang* et al. ("*Fang*") was filed on November 8, 2019. *Fang* is a national stage of a PCT application that was filed on May 25, 2017, and claims priority to a Chinese patent application filed on May 18, 2017. *Fang* published on July 2, 2020. *Fang* qualifies as prior art under at least 35 U.S.C. §§102(a)(1) and (2).

D. Identification of Challenge & Statement of Precise Relief Requested

Petitioners request IPR of Claims 1-3, 5-15, and 17-20 on the following grounds, and that those claims be cancelled under 35 U.S.C. §318(b).

Ground	Type	Summary
1	§103	Claims 1, 3, 5-7, 9, 12, 13, 15, and 17-19 are rendered obvious by *Ye* in view of *Basu*
1A	§103	Claims 1-3, 5-9, 12-15, and 17-20 are rendered obvious by *Ye* in view of *Basu* and *Yun*

2	§103	Claims 2, 5, 6, 14, 17, and 18 are rendered obvious by *Ye* in view of *Basu* and *Xia*
3	§103	Claims 7, 9, and 19 are rendered obvious by *Ye* in view of *Basu* and *Chang*
3A	§103	Claims 7, 9, and 19 are rendered obvious by *Ye* in view of *Basu, Yun,* and *Chang*
4	§103	Claim 10 is rendered obvious by *Ye* in view of *Basu* and *Yu*
4A	§103	Claim 10 is rendered obvious by *Ye* in view of *Basu, Yun,* and *Yu*
5	§103	Claim 11 is rendered obvious by *Ye* in view of *Basu* and *Fang*
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6	§§ 102 / 103	Claims 1, 3, 5-9, 12, 13, and 17-20 are anticipated and/or rendered obvious by *Sakai*
6A	§103	Claims 1-3, 5-9, 12-15, and 17-20 are rendered obvious by *Sakai* in view of *Yun*
7	§103	Claim 10 is rendered obvious by *Sakai* in view of *Yu*
7A	§103	Claim 10 is rendered obvious by *Sakai* in view of *Yun* and *Yu*
8	§103	Claim 11 is rendered obvious by *Sakai* in view of *Fang*
8A	§103	Claim 11 is rendered obvious by *Sakai* in view of *Yun* and *Fang*

IV. ’136 PATENT OVERVIEW

A. Summary of Subject Matter

The ’136 Patent relates to solar cells that convert light to electricity. EX1001, 1:15-17. As the ’136 Patent describes, solar cells are a type of semiconductor device manufactured by forming PN junctions and other functional layers through dopant diffusion in silicon, and etching the silicon wafer to create surface textures. *Id.*, 5:54-60; 6:4-14. One or both surfaces of the solar cell can be textured to reduce light

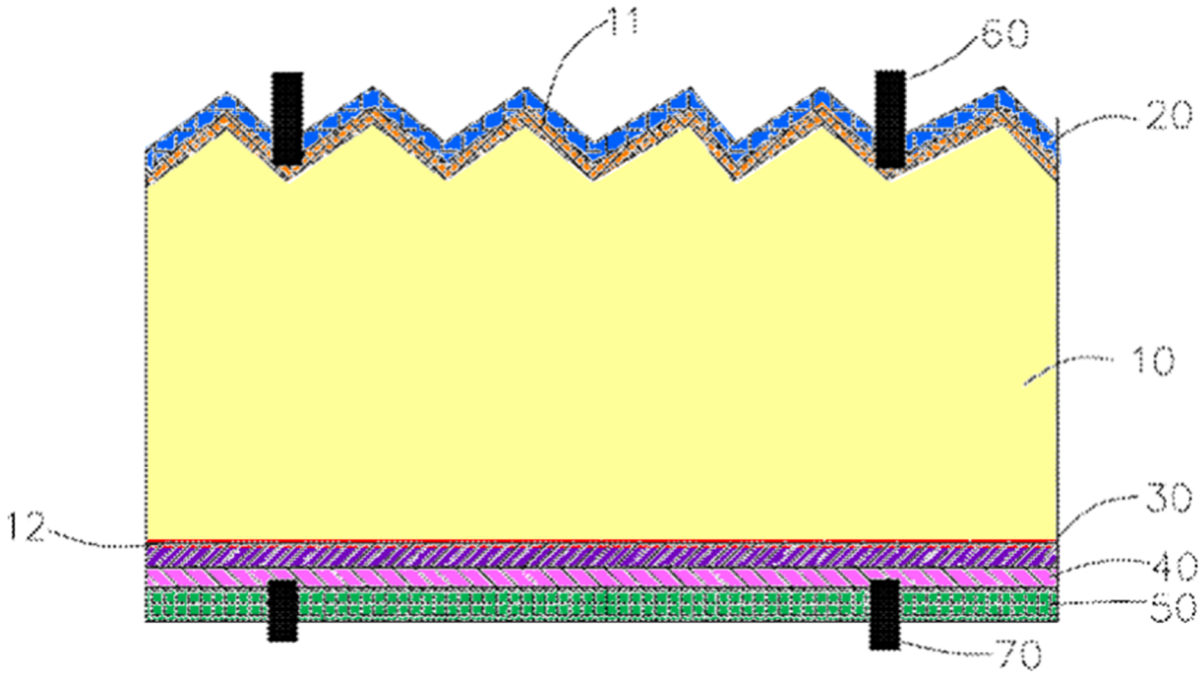
reflection and improve light-conversion efficiency. *Id.*, 6:29-34.

The claimed solar cells have textures on both front and rear surfaces of the substrate. *Id.*, Claim 1; Figures 1-2. The rear surface has non-pyramid texture structures with a maximum texture-surface distance of 45 μm. *Id.* The front surface of the substrate has pyramid-shaped texture structures with a maximum pyramid height of 5 μm. *Id.* The solar cell further has a passivation layer on the pyramid-shaped texture structures of the substrate. *Id.* The rear surface has a tunnel oxide layer (on the non-pyramid texture structures), a doped conductive layer (on the tunnel oxide layer), and a passivation layer (on the doped conductive layer). *Id.*

Surfaces and layers of the claimed solar cells are listed and colored in Figure 1 below:

- semiconductor silicon substrate 10 (yellow) (claim 1[a])
- rear substrate surface 12 with non-pyramid texture structures (red) (claim 1[b])
- front substrate surface 11 with pyramid texture structures (orange) (claim 1[c])
- passivation layer 20 (blue) on the pyramid texture structures of the front substrate surface (claim 1[e])
- tunnel oxide layer 30 (purple) on the non-pyramid texture structures of the rear substrate surface (claim 1[f])

- doped conductive layer 40 (pink) on the tunnel oxide layer of the rear surface (claim 1[g])
- passivation layer 50 (green) on the doped conductive layer of the rear surface (claim 1[h])



Id., 5:20-6:3, Figure 1 (annotated). As discussed in the '136 Patent's background section, the tunnel oxide layer is a feature of an "N-type tunnel oxide passivated contact (TOPCon) solar cell," which was known in the art before the '136 Patent. *Id.*, 1:21-24.

Figure 2 is an image looking downward on the front-side pyramid texture structures, and Figure 3 is an image looking downward on the rear-side non-pyramid texture structure. The '136 Patent states that the non-pyramid texture structures are

made by polishing the rear surface with an alkali solution. *Id.*, 7:38-40. It states that the non-pyramid texture structures have "polygonal" top surfaces with a maximum size of 45 μm and some of the non-pyramid structures are at least partially "stacked" on one another. *Id.*, 1:50-59; FIG. 3.

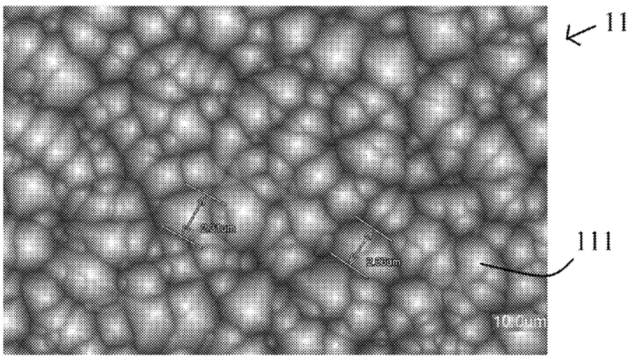


FIG. 2

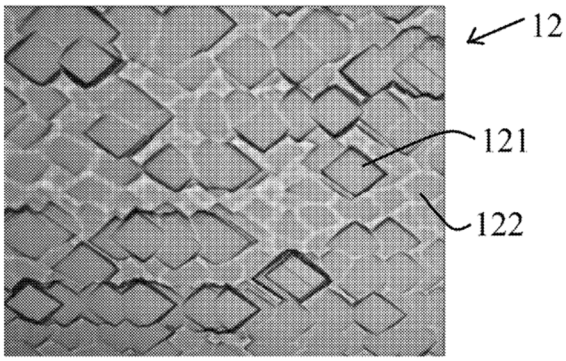


FIG. 3

Front Side **Rear Side**

The independent Claims of the '136 Patent recite a single solar cell (Claim 1) and a photovoltaic module with two or more solar cells (Claim 13), but both recite the same layer-structure illustrated in FIG. 1. *Id*. Dependent claims 2-12 and 14-20 each specify details of one or more layers of the solar cell. *Id*.

B. Claim Listing

Claim 1 is representative of the '136 Patent's claims and is reproduced in Grounds 1 and 1A below. All challenged claims are listed in EX1019.

C. Relevant Prosecution History

The application that issued as the '136 Patent was filed on October 12, 2022, as a divisional of U.S. Patent Application No. 17/459,689. EX1001. The '136

Patent's prosecution was short. *See generally* EX1018. In the two non-final Office Actions, the only rejections were based on double-patenting and there were no prior art-based rejections. *See* EX1018.[2]

The Examiner issued a Notice of Allowance citing *Sakai* as the closest prior art. The Examiner found that *Sakai* disclosed a solar cell (claim 1[p]) with a substrate (claim 1[a]) having the claimed tunnel oxide layer (claim 1[f]), passivation layers (claim 1[e] and 1[h]), and doped semiconductor layer (claim 1[g]). EX1018, 12-17. The Examiner also noted that *Sakai* disclosed textured structures on the rear and light receiving surfaces, including pyramid and "truncated four-sided pyramidical" texture structures with a size of less than 15 micrometers, as in claims 1[b] and 1[c]. However, the Examiner asserted that *Sakai* "does not clearly show among the overlapping unevenness about the distance of the top face of an outermost protruding part, and the top face of the protruding part which adjoins it." EX1018, 15-16. The '136 Patent issued on November 21, 2023.

D. Level of Ordinary Skill in the Art

As of the '136 Patent's priority date, a person of ordinary skill in the art ("POSITA") would have a bachelor's degree in electrical engineering, applied

[2] The parent application's prosecution also included no prior art rejections or substantive arguments. *See* generally EX1007.

physics, materials science, or a related discipline and at least two years of experience designing, developing, or researching the design and/or manufacture of solar cells or related technologies. EX1003, ¶¶22-23, 51-52. This definition is flexible, where more education may substitute for industry experience or vice versa. *Id*.

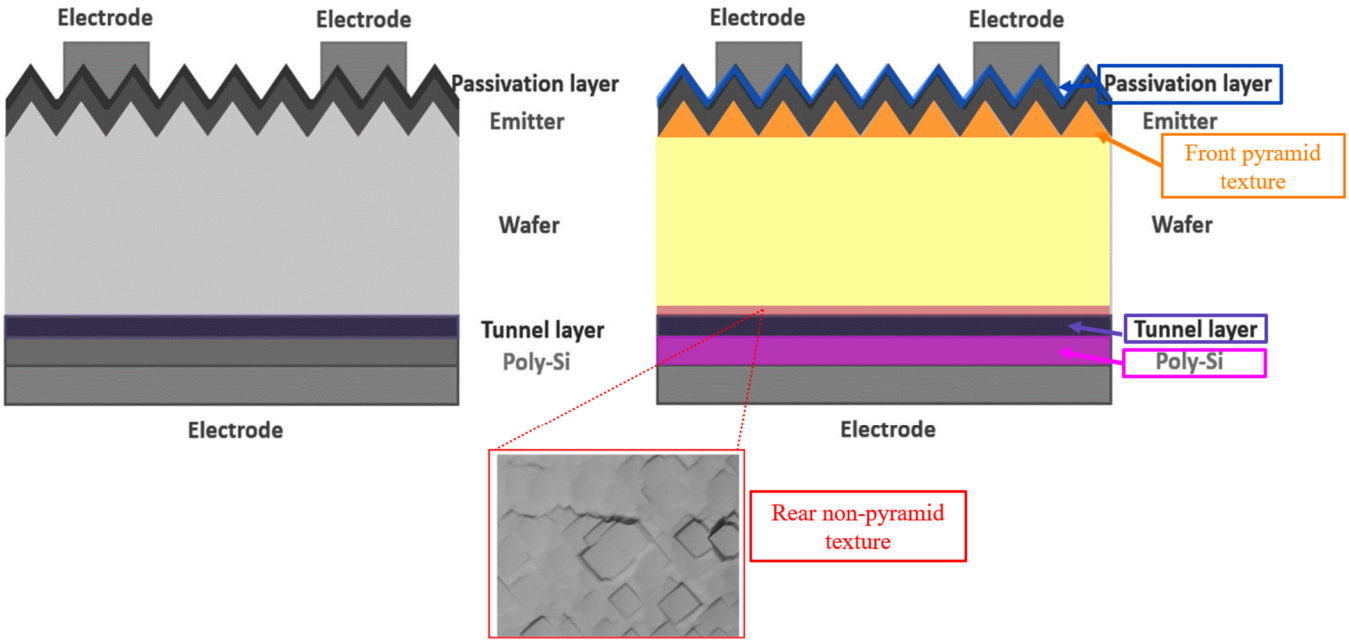
V. PRIOR ART SUMMARY

As explained by Petitioners' expert, the '136 Patent's claimed subject matter was well known before its priority date. EX1003, ¶31. As the '136 Patent itself discusses, TOPCon solar cells made of silicon substrates with textured front and rear surfaces and various layers deposited on them were known in the prior art. EX1001, 1:20-37. In addition to POSITAs' background knowledge, the following prior art demonstrates that solar cells within the '136 Patent claims were well-known and obvious to POSITAs. EX1003, ¶31.

A. *Ye* (EX1004)

Ye relates to a method of manufacturing TOPCon solar cells. EX1004, [0003]-[0004], [0018]. *Ye*'s solar cells have texture surfaces on both the front and rear sides of a silicon wafer. *Id*. Figure 1 below shows the front side includes a textured surface with pyramid-shaped substructures (orange) and a passivation layer (blue). The rear surface of the substrate (red) has non-pyramid-shaped textures. *Id.*, Figure 3. The rear side further has the following series of layers: a tunnel oxide layer ("tunnel layer") on the non-pyramid textured surface (purple), a doped conductive layer

("Poly-Si") on the tunnel oxide layer (pink), and another passivation layer on the doped conductive layer. *Id.*, ¶0038; Claim 1.



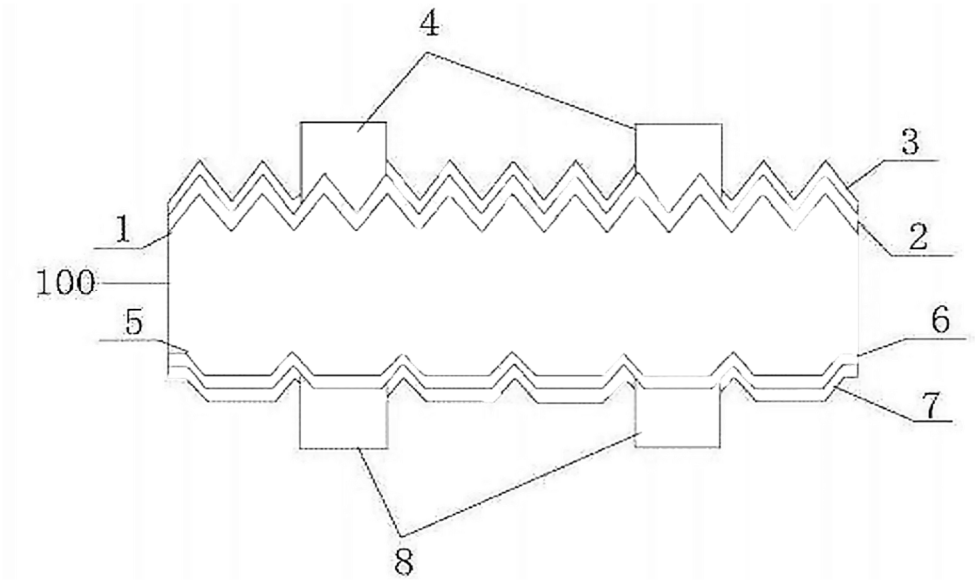
EX1004, Figs. 1 (annotated, right), 3.

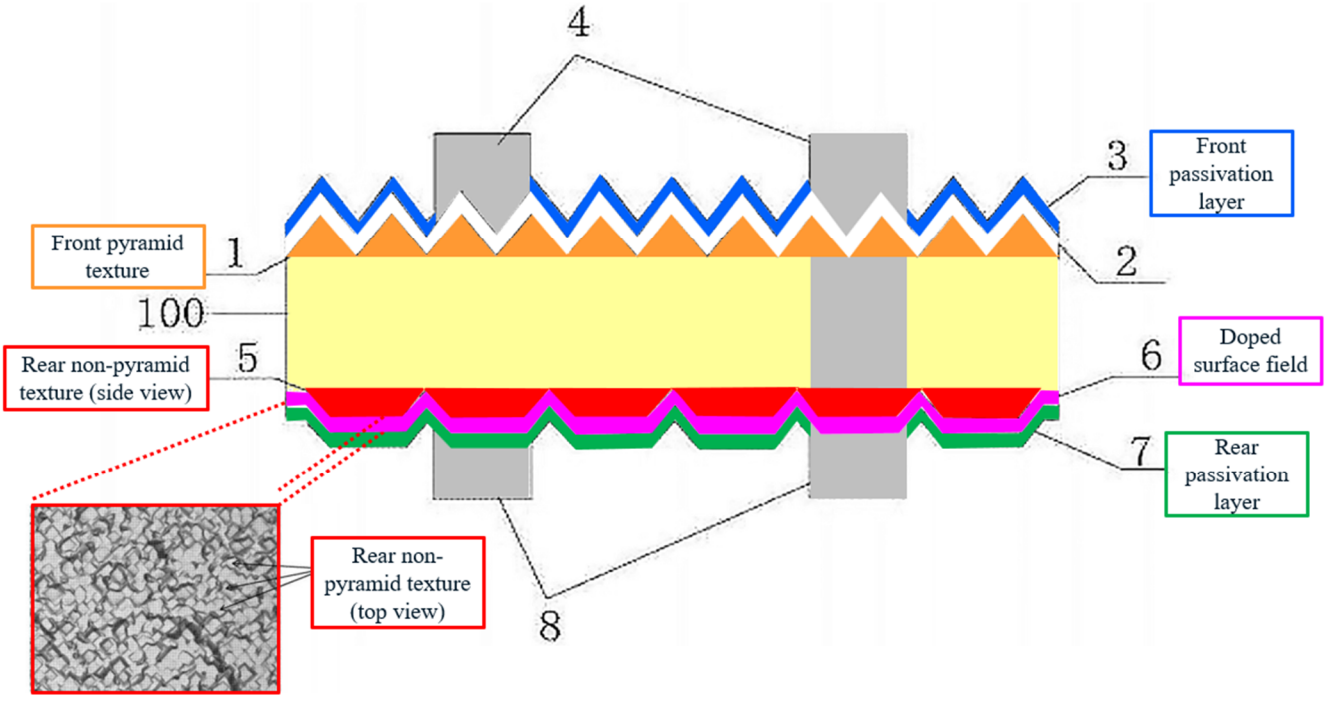
Figure 3 shows the non-pyramid structures on the rear surface that have polygonal top surfaces. *Ye* was not of record during the '136 Patent's prosecution.

B. *Yun* (EX1005)

Yun relates to bifacial solar cells made of monocrystalline silicon. EX1005, Abstract, Claim 1. *Yun*'s solar cells use both front and back surfaces of a substrate 100 to receive light and both surfaces are textured. *Id.*, ¶0002. As shown in Figure 1 below, the front side has pyramid-shaped textures 1 (orange) on the substrate surface and a front passivation layer 3 (blue). *Id.*, ¶0029, 0034. The rear side has non-pyramid "platform-shaped" shaped surface textures (red) that have an upper planar

surface with a side length of 10 µm. *Id.*, [0029], [0032], Abstract. The rear side further has a doped surface field 6 (pink) and a passivation layer 7 (green) on the non-pyramid texture. *Id.*, [0029].





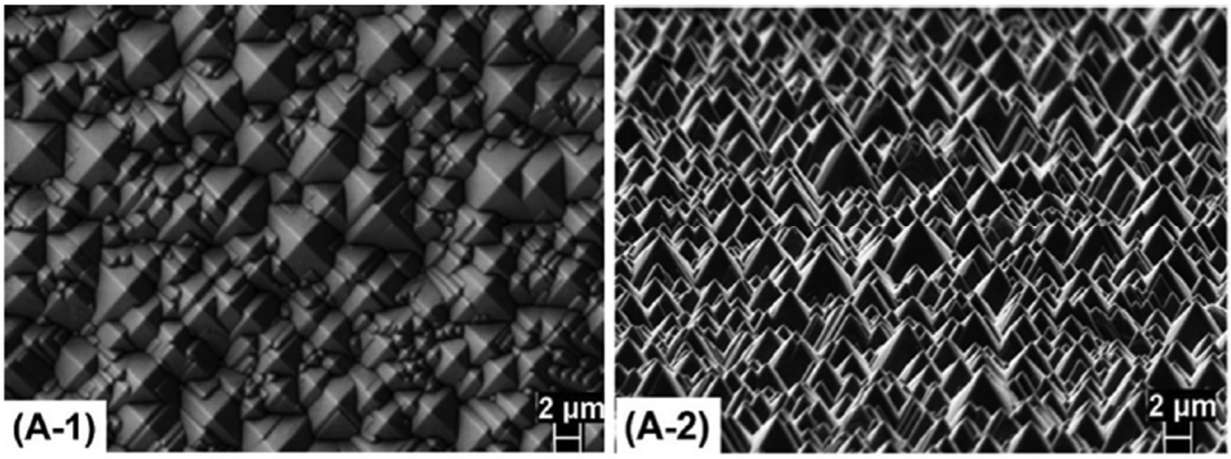
EX1005, Figures 1-2 (annotated, bottom).

Figure 2 shows that the "platform-shaped" structures (*i.e.*, non-pyramid textures) have polygonal top surfaces, which have a maximum side length of 10 μm. *Id.,* Claim 1. The platform-shaped structures can be dispersed or partially overlapping. *Id. Yun* was not of record during the '136 Patent's prosecution.

C. *Basu* (EX1012)

Basu is a scientific paper about optimizing pyramid structures formed on the surfaces of monocrystalline silicon wafer solar cells. EX1012, 590.[3] *Basu* describes the effect of pyramid heights on solar cell efficiency. *Id. Basu* studies various ranges of pyramid heights of the surface textures formed using alkaline texture processes and concludes that the smaller pyramids—~5 μm maximum among the ranges studied—give the highest fill factor and efficiency. *Id.*, 597. Figure 4 shows SEM micrographs of pyramid textures from a top view (A-1) and an angular view (A-2) with a maximum height of 5 μm.

[3] Citations are to EX1012's native page numbering.



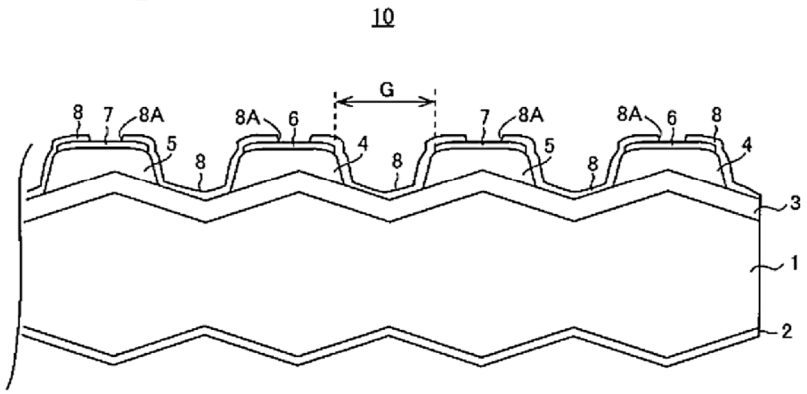
Top View **Angular View**

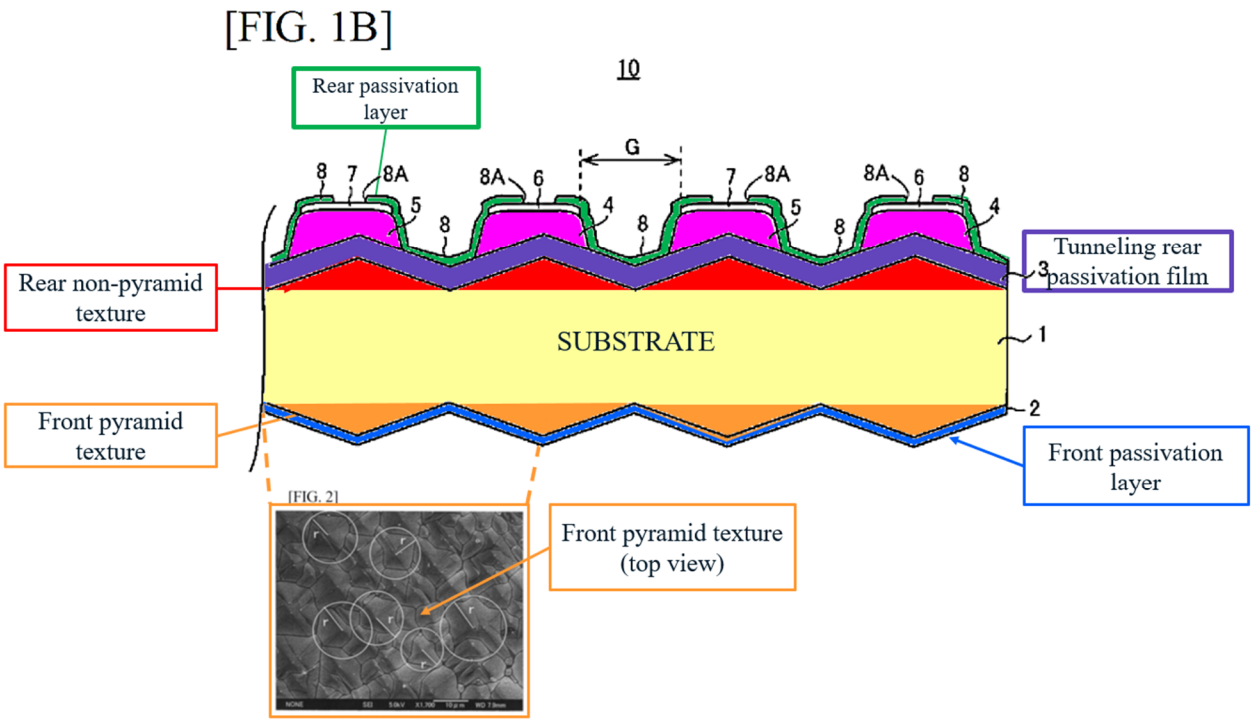
Basu was not of record during the '136 Patent's prosecution.

D. *Sakai* (EX1009)

Sakai relates to TOPCon solar cells (photoelectric conversion elements) with textured front and rear substrate surfaces. As shown in Figure 1B below, the front texture (orange) and rear texture (red) of the substrate are made by etching on a silicon substrate and can be pyramid-shaped (FIG. 2) or truncated pyramid-shaped (not shown). *Id.*, ¶0042, 0045.

[FIG. 1B]





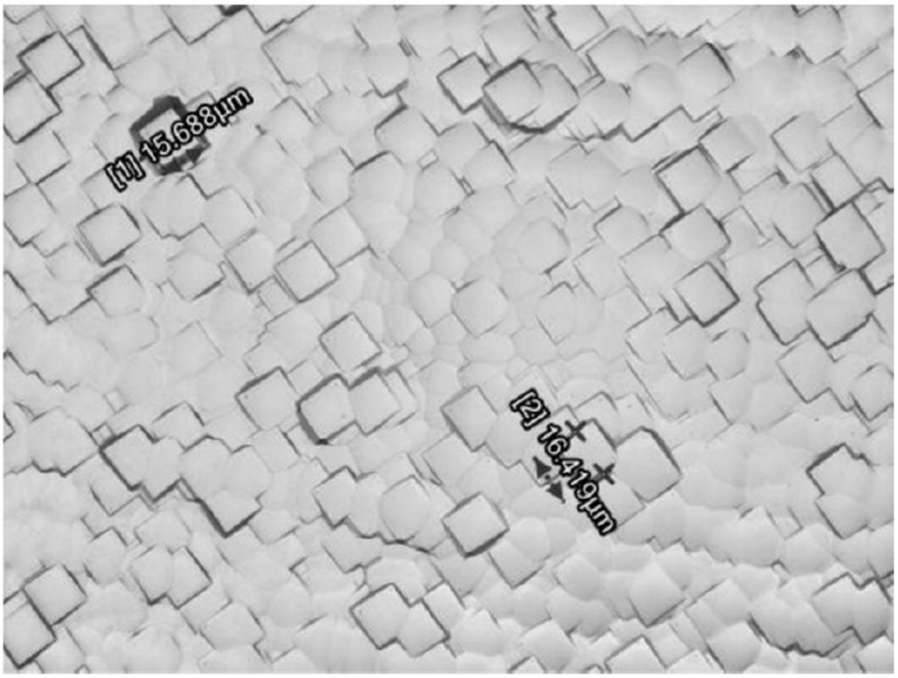
EX1009, FIGS. 1B and 2 (annotated, bottom).

The texture structure has a convex portion with a size equivalent to a circumscribed circle with a diameter of less than 15 μm. *Id.*, Claim 5. The textures have unevenness including overlapping portions. *Id.*, [0042]. FIG. 1B shows the front side of the solar cell has an antireflective passivating film 2 (blue) on the front substrate texture. *Id*. The back side of the solar cell has a film 3 (purple) of a thickness that "allows carriers (electrons and holes) to tunnel." *Id.*, [0042]; *see also id.,* [0159]. On top of film 3 are doped semiconductor layers 4 and 5 (pink) (*id.,* [0147]-[0148]), followed by a protective film 8 (green) that passivates the semiconductor layers (*id.*, [0053], [0078]).

Sakai was mentioned in the '136 Patent's Notice of Allowance as the closest prior art. EX1018, 16-17. However, the Examiner erred in distinguishing *Sakai*. The Examiner asserted: "*Sakai* does not clearly show among the overlapping unevenness about the distance of the top face of an outermost protruding part, and the top face of the protruding part which adjoins it." *Id.* But the '136 Patent's independent claims do not recite any "distance of the top face of an outermost protruding part, and the top face of the protruding part which adjoins it." It also is unclear whether the Examiner considered *Sakai*'s complete disclosure. *Sakai* was filed and published in Japanese and has no counterpart in any other country. The copy of *Sakai* in the '136 prosecution history (EX1018, 302-391) only contains an English translation of its Abstract, which does not cover all of *Sakai's* disclosures relied upon in this Petition (*see* §VII.F, *infra*). Nor is there any indication that the Examiner could read or comprehend *Sakai*'s technical subject matter in Japanese.

E. *Xia* (EX1006)

Xia relates to polishing crystalline silicon surfaces for TOPCon solar cells. EX1006, [0001]-[0002]. *Xia* discloses silicon wafers having a surface roughness of 10-20 μm, and a pre-polishing step that can reduce it to 1-3 μm. *Id.*, [0007]. Figure 1 (below) is a microscope photograph of the polished crystalline silicon surface on the wafer's rear side. The polished surface has "uniform and smooth square structures" about 15-16 μm in size. *Id.*, [0033].



F. *Chang* (EX1023)

Chang teaches TOPCon solar cells having rear tunneling layers on a silicon substrate to enable passivation and carrier tunneling, specifying materials including silicon oxide, silicon nitride, and silicon oxynitride with a tunneling layer thickness of about 0.5–2 nm. EX1023, 5:22-26, 5:30-33, 7:8-15.

G. *Yu* (EX1016)

Yu is a scientific paper about improving tunnel oxide passivated contacts (TOPCon) in bifacial solar cells, and describes optimized designs for their front surfaces. EX1016, 1. Fig. 4 of *Yu* below is a diagram of the solar cells fabricated in its experiments.

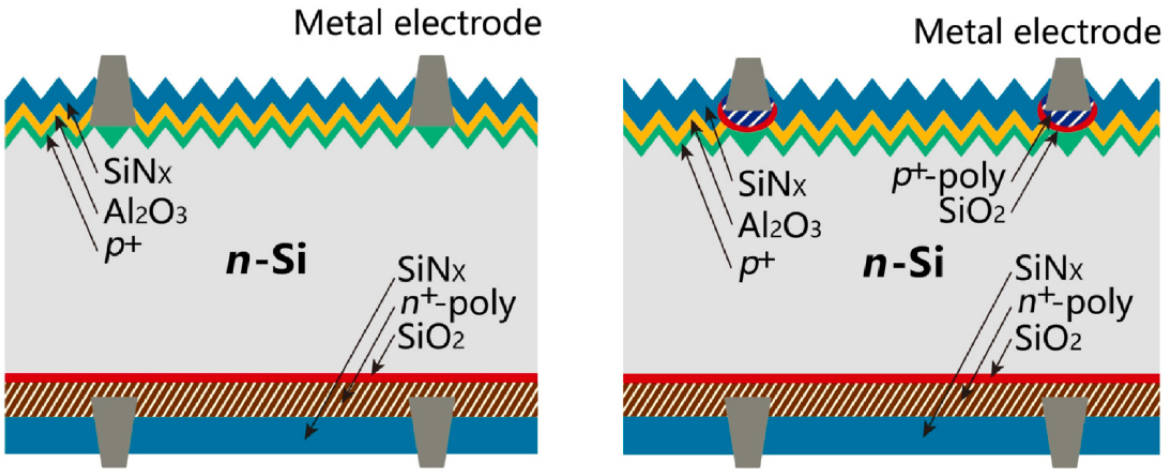


Fig. 4. Solar cell construction diagram.

Those cells include 5-nm aluminum oxide and 75-nm silicon nitride passivation layers on the boron emitter on the substrate's front surface. *Id.*, 3.

H. *Fang* (EX1034)

Fang relates to PERC-type solar cells prepared using plasma enhanced chemical vapor deposition (PECVD) techniques to form composite passivation films on silicon wafers. *Id.*, Abstract, [0068]. *Fang* describes various embodiments of composite passivation films 3 formed using its methods, which include 2-6 sublayers. *Id.*, Figs. 3-8, [0077]-[0084]. Each sublayer can be made of various materials, including aluminum oxide, silicon nitride, and silicon oxynitride, and *Fang* discloses thickness ranges for those sublayers. *Id.*, [0085].

VI. CLAIM CONSTRUCTION

Claim terms are construed according to their ordinary meaning as understood by POSITAs and the intrinsic record pertaining to the patent. 37 C.F.R. §42.100(b).

In certain instances explained below, Petitioners have applied interpretations of claim terms based on Patent Owner's apparent interpretation of those terms in its infringement allegations against Petitioners in the parallel district court litigation. Otherwise, Petitioners apply the ordinary meanings of the claim terms.[4] Express constructions are not required in this proceeding because the prior art invalidates the claims under all plausible constructions.

VII. ASSERTED GROUNDS OF INVALIDITY

A. Ground 1: Claims 1, 3, 5-7, 9, 12, 13, 15, and 17-19 are rendered obvious by *Ye* in view of *Basu*

1. *Rationale for Combining Ye* and *Basu*

The '136 Patent relates to the field of solar cells generally, and more specifically to optimizing solar cell design (*e.g.*, of TOPCon cells) to improve efficiency, *e.g.*, by using textured front and back surfaces. EX1001, 1:15-18, 1:41-46. *Ye* also relates to the field of solar cells and prepares a laminated thin-film passivated contact structure in a way that optimizes a solar cell's design and improves its quality (*e.g.*, avoiding delamination). EX1004, [0001], [0008]-[0009]. *Ye* identifies TOPCon solar cells as a type of cell improved by these optimizations. EX1004, [0003]-[0008]. *Basu* also relates to the field of solar cells made from

[4] Petitioners reserve all rights to challenge claims under §112 and/or seek additional or different constructions of terms in other proceedings.

monocrystalline silicon wafers, and optimizes solar cell structure (*e.g.*, pyramid height) to maximize the efficiency. EX1012, 590; EX1003, ¶¶73-74. Alternatively, the '136 Patent is concerned with the problem of optimizing the textured surfaces and other layers of solar cells to improve the cell's open-circuit voltage, reduce contact resistance of the cell's electrodes, and improve the cell's efficiency. EX1001, 1:40-47, 5:29-37. *Ye* and *Basu* each teaches optimizing the cell's textured surfaces and/or their adjacent layers to improve cell efficiency or quality or reduce cost. EX1004, Abstract, [0022] (laminated thin film "maintains a relatively low sheet resistance, which is beneficial for metal contacting…" and "achieve[s] high open-circuit voltage"); EX1012, 597. Thus, *Ye* and *Basu* both relate to problems with which the '136 Patent inventors were concerned. Therefore, for both reasons above, *Ye* and *Basu* are analogous art to the '136 Patent. EX1003, ¶¶83-84.

Ye describes solar cells having textured front and rear surfaces. EX1004, Figures 1, 3. The front surface texture has a pyramid shape, and the rear surface has a non-pyramid shape. *Id. Basu* teaches that solar cell efficiency can be maximized by choosing optimal pyramid heights for the front surface textures. EX1012, 597. *Basu* studies three ranges of pyramid heights of the surface textures, and concludes that the smaller pyramids (*i.e.*, ~5 μm maximum) give the highest fill factor and efficiency. *Id.*, 594, 597. POSITAs would have been motivated to use pyramids of the optimal height range disclosed in *Basu* (*i.e.*, ~5 μm maximum, or 2-5 μm) for

the front surface texture in *Ye* to improve the solar cell efficiency. EX1003, ¶85. POSITAs would have had a reasonable expectation of success in adopting the pyramid heights disclosed in *Basu* for *Ye's* solar cells, because it merely optimizes the size of a known texture structure (pyramids) within a known range of pyramid heights using a known method (*Basu*'s optimal height of no more than ~5 μm) to obtain predictable results (improved efficiency). EX1003, ¶85.

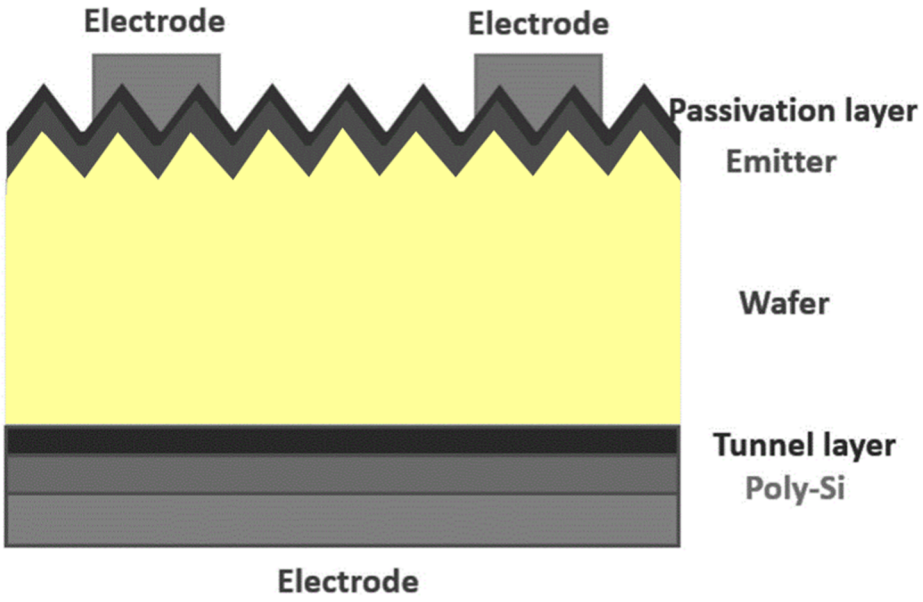
2. *Claim 1*

a) Claim 1[p]: "A solar cell"

To the extent the preamble is limiting, *Ye* discloses various embodiments of "solar cells" with TOPCon structures. EX1004, [0001]-[0002]; Figure 1; *see also id.,* [0018], [0020]-[0024], [0037]-[0038] ("The present invention relates to the technical fields of solar cells …); EX1003, ¶86; *see also* EX1012, 590, 597 (studying pyramid height in "inline-diffused c-Si solar cell").

b) Claim 1[a]: "a semiconductor substrate,"

POSITAs would have understood that *Ye's* "n-type silicon wafer" (yellow below) on which the silicon oxide layer grows is a semiconductor substrate. EX1004, Abstract, [0007], [0011], [0030]-[0032], [0038]; EX1003, ¶87.

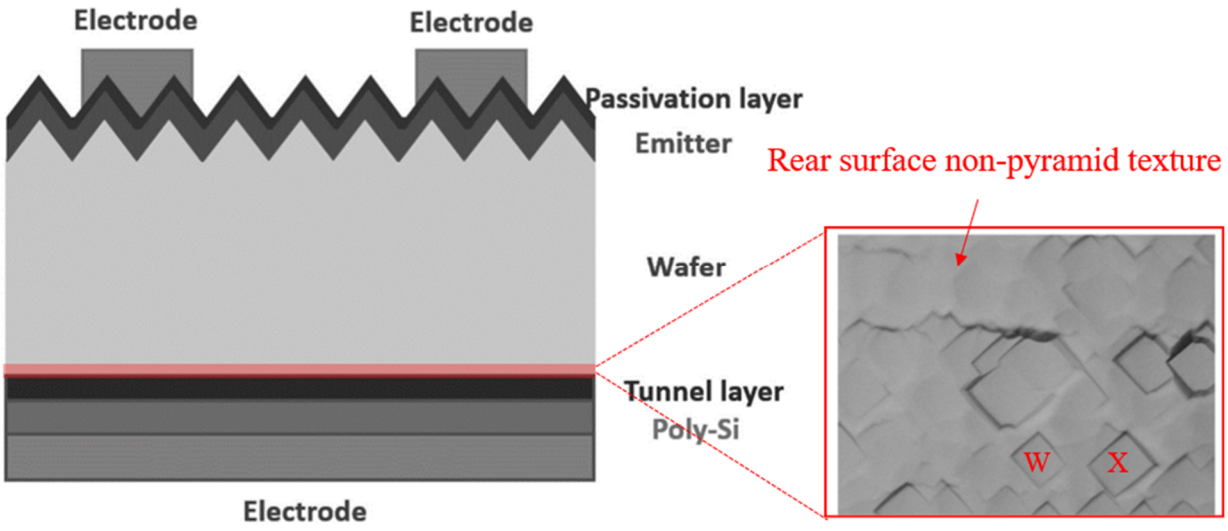


EX1004, Figure 1 (annotated); EX1003, ¶88; *see also* EX1012, 590, 592 (cells on an "industrial monocrystalline silicon (c-Si) wafer").

c) Claim 1[b]: "wherein a rear surface of the semiconductor substrate has a first texture structure, the first texture structure has a non-pyramid-shaped microstructure and includes two or more first substructures at least partially stacked on one another, a top surface of the first substructure is a polygonal plane, and a one-dimensional size of the top surface of the outermost first substructure is less than or equal to 45 μm;"

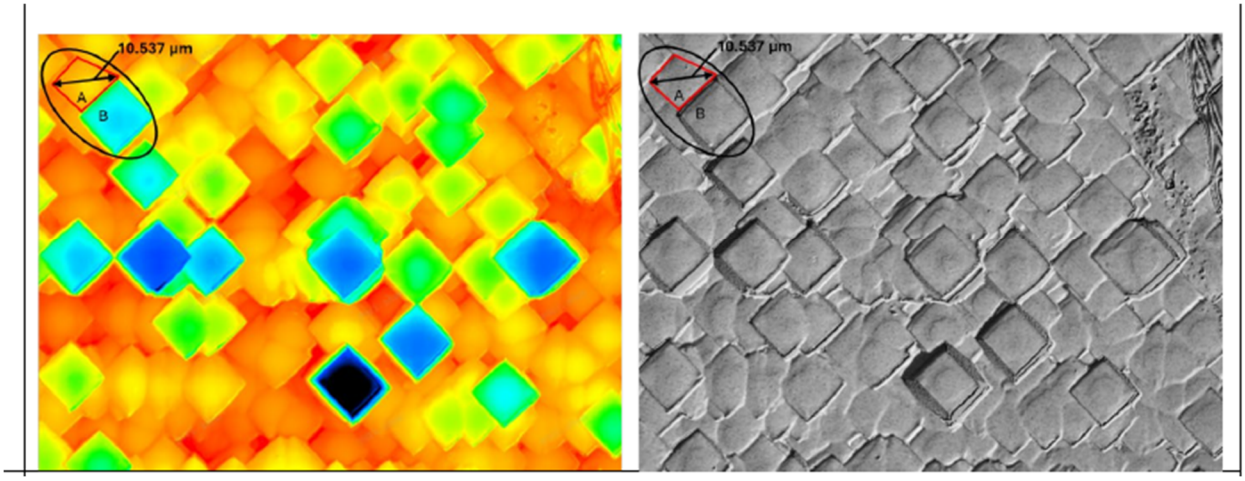
Ye discloses that the solar cell has a textured rear surface with non-pyramid-shaped substructures. EX1004, Figures 1-3. Figure 3 shows a top view of the top surface of those substructures, which appear as four-sided polygonal planar surfaces located on the rear surface of the solar cell. As shown below, at least some adjacent texture substructures (*e.g.*, "W" and "X") do not stack on one another. *Id.* Based on the typical size and scale of TOPCon solar cells and the textured substructures

formed on their substrates, POSITAs would have recognized that the top surfaces of these substructures are smaller than 45 μm in any dimensional size. EX1003, ¶¶89-90.

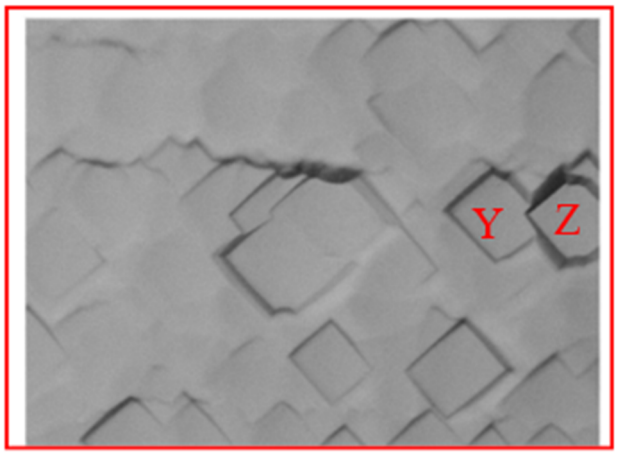


EX1004, Figures 1, 3 (annotated).

In their complaint for patent infringement against Petitioners, Patent Owner has interpreted "two or more first substructures at least partially stacked on one another" in claim 1[b] to read on polygonal shaped structures labeled "A" and "B" below.



EX1021, 10. To the extent the structures labeled "A" and "B" are "at least partially stacked on one another," then structures in Figure 3 of *Ye* labeled "Y" and "Z" below also would be "at least partially stacked on one another."

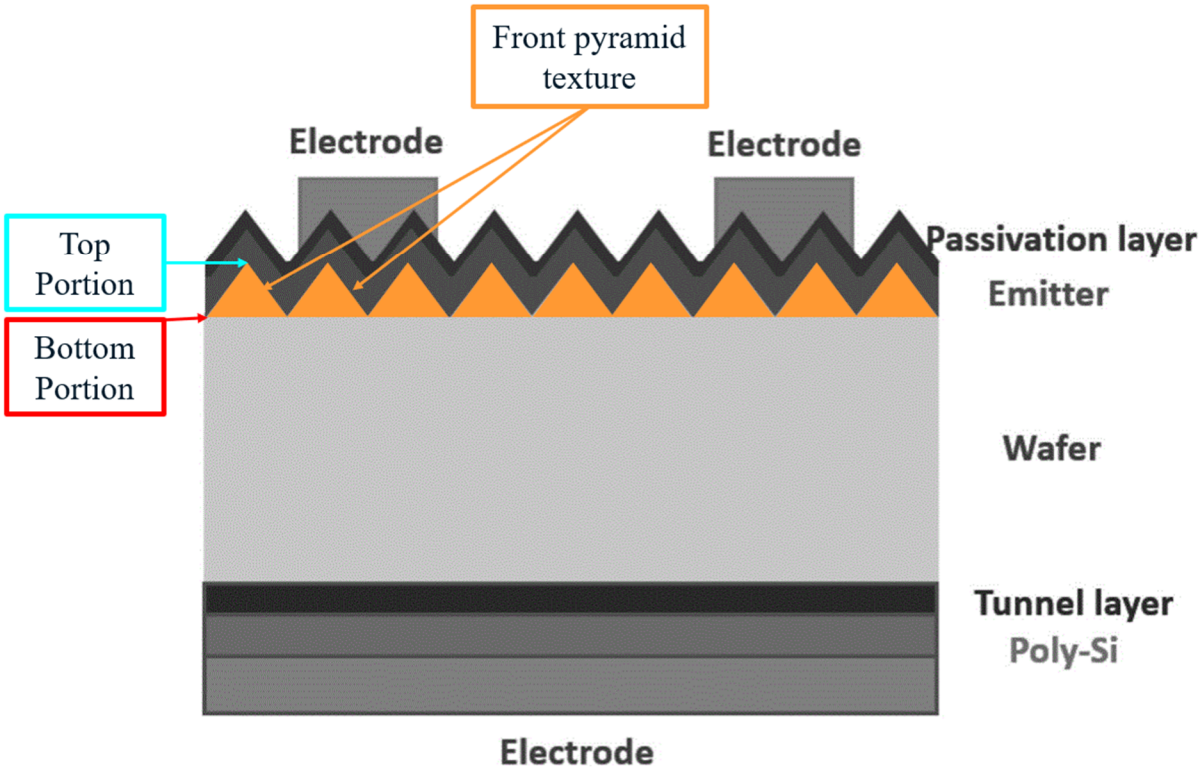


Therefore, based on Patent Owner's interpretation, *Ye* discloses this requirement of claim 1[b].[5] EX1003, ¶¶91-93.

[5] If the Board does not adopt Patent Owner's interpretation, as discussed in Ground 1A, *Yun* discloses this requirement under its plain meaning.

d) Claim 1[c]: "wherein a front surface of the semiconductor substrate has a second texture structure, the second texture structure includes a pyramid-shaped microstructure, the pyramid-shaped microstructure includes a top portion away from the front surface of the semiconductor substrate and a bottom portion close to the front surface of the semiconductor substrate, and"

POSITAs would have understood that *Ye* discloses that the front surface of the solar cell substrate has a textured structure including pyramid-shaped microstructures. EX1004, Figure 1. As shown, the pyramid-shaped microstructure includes a top portion away from the substrate and a bottom portion close to the substrate. *Id.*; EX1003, ¶94.

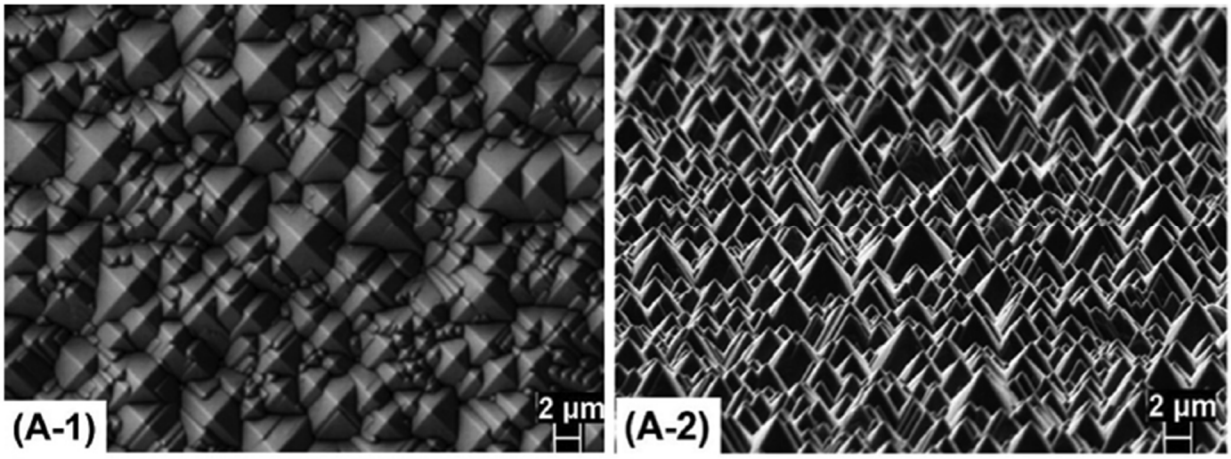


EX1004, Figure 1 (annotated).

e) Claim 1[d]: "in a direction away from the front surface and perpendicular to the front surface, a distance between the top portion and the bottom portion of the pyramid-shaped microstructure is less than or equal to 5 μm;"

POSITAs would have understood that claim 1[d] corresponds to the pyramid heights of the front surface texture. EX1003, ¶95. *Ye* does not specify the height of the pyramid-shaped texture structures on the cell's front surface.

Basu studies "[t]he effect of the front pyramid heights on the efficiency of … solar cells" and discloses various ranges of pyramid heights for the front surface textures, concluding that smaller pyramid heights (*i.e.*, ~5 μm maximum), as shown below, give the highest fill factor and solar cell efficiency. EX1012, 590, 597.

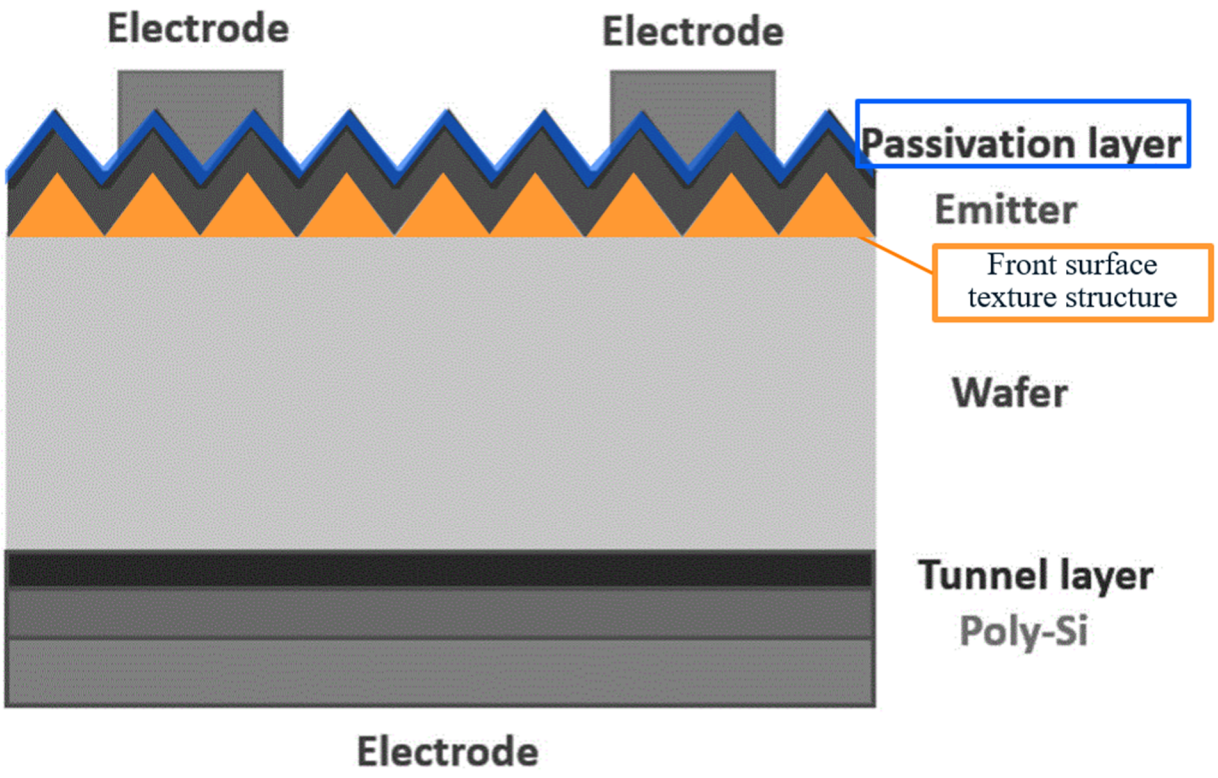


Top View **Angular View**

EX1012, Fig. 4. Therefore, in light of *Basu*, POSITAs would have found it obvious to design *Ye's* solar cells to have front surface pyramid texture structures having a height of less than 5 μm. EX1003, ¶96.

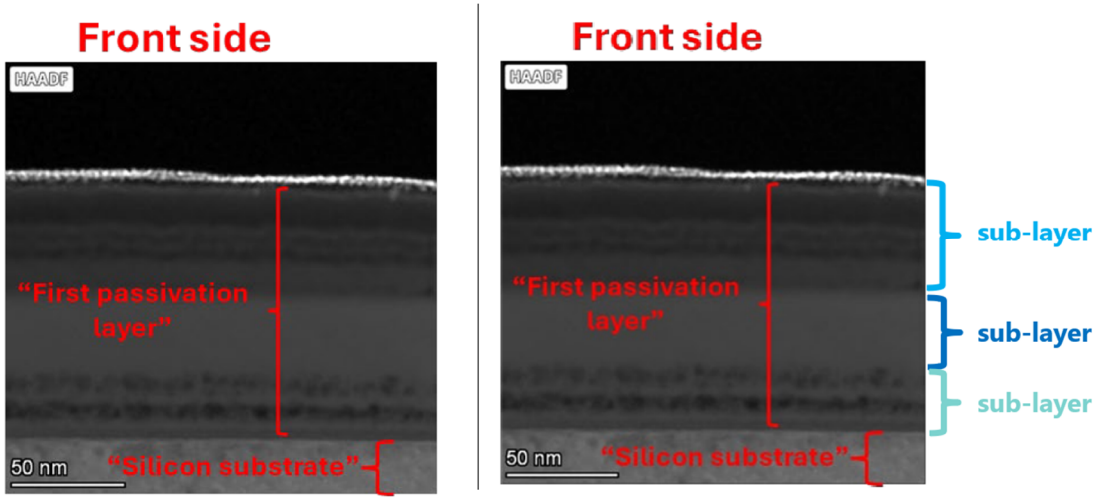
f) Claim 1[e]: "a first passivation layer located on the second texture structure of the front surface of the semiconductor substrate;"

Ye discloses the solar cell's front side has a passivation layer located on an emitter layer, which in turn is located on the front surface texture structure. EX1004, [0019], [0022], [0031]-[0034], [0038]; Figure 1.

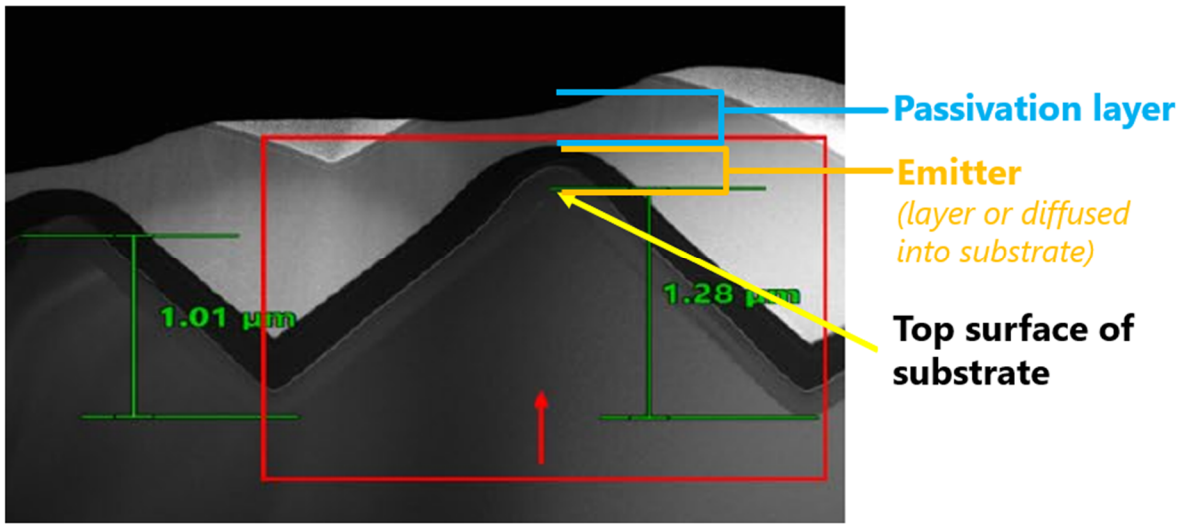


EX1004, Figure 1 (annotated).

In their complaint for patent infringement against Petitioners, Patent Owner has interpreted "a first passivation layer located on the second texture structure" in claim 1[e] to require a layer in the accused products that contacts what Patent Owner labels as the substrate (*see* below, left, EX1021, 12 (Patent Owner's annotation)).



However, as shown in the same figure relied upon by Patent Owner, Patent Owner relies upon multiple distinct layers as the alleged "passivation layer," including an emitter layer that resides between the front substrate surface and the passivation layer (*see* above, right, multiple distinct layers identified in Petitioner's annotations). The following figure from Patent Owner's complaint more clearly illustrates what Patent Owner regards as the top of the front surface of the substrate (see top end of 1.28 µm measurement in green below), as well as the emitter layer residing on that substrate surface and a passivation layer residing on the emitter layer.

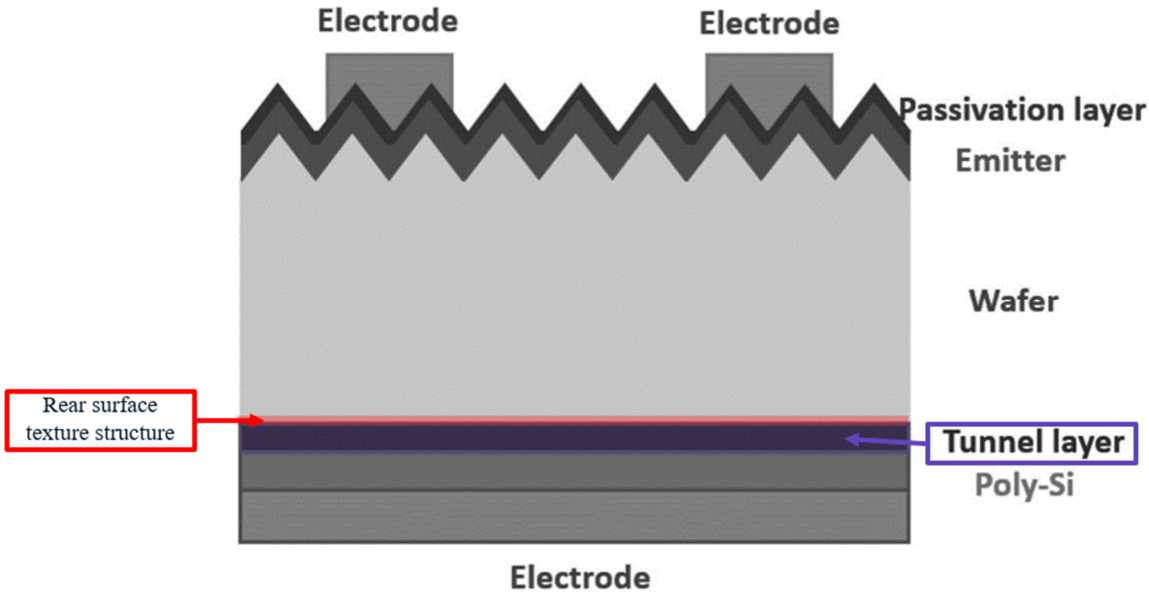


EX1021, 11 (annotated). Therefore, to the extent Patent Owner's identification of a passivation layer located on an emitter layer, which in turn is located on a front substrate surface, shows a "first passivation layer ***located on*** the second texture structure" of the front substrate surface, then *Ye*'s passivation layer, either alone or in combination with the emitter layer, also would meet that limitation. Therefore, based on Patent Owner's interpretation, *Ye* discloses this requirement of claim 1[e].[6] EX1003, ¶¶97-99.

g) Claim 1[f]: "a tunnel oxide layer located on the first texture structure of the rear surface of the semiconductor substrate;"

[6] If the Board does not adopt Patent Owner's interpretation, as discussed in Ground 6, *Sakai* discloses this requirement under any plausible construction.

Ye discloses "growing a silicon oxide layer … to form a tunnel-oxide passivated contact structure," which results in a silicon oxide layer as the tunnel oxide layer. EX1004, Abstract. *Ye* also discloses a "TOPCon crystalline silicon solar cell consist of … a silicon oxide passivating tunneling layer," located on the rear texture structure of the solar cell, as shown below ("Tunnel layer"). *Id.*, [0004]; EX1003, ¶100.

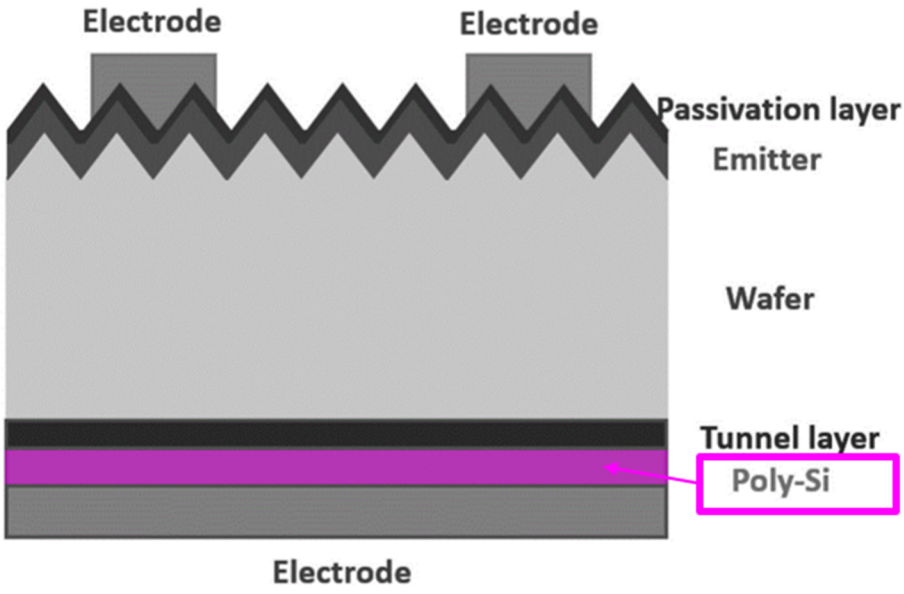


EX1004, Figure 1 (annotated).

h) Claim 1[g]: "a doped conductive layer located on a surface of the tunnel oxide layer; and

Ye discloses "[a] heavily doped polysilicon thin film" on top of the tunnel layer on the solar cell's rear side. EX1004, [0023]. POSITAs would have recognized

that this layer is "a doped conductive layer" located on the tunnel oxide layer. EX1004, [0023], [0035], [0039]; EX1003, ¶101.



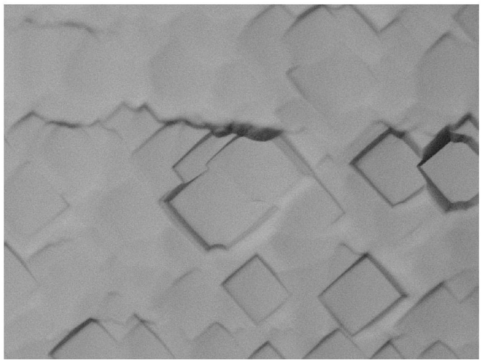
EX1004, Figure 1.

i) Claim 1[h]: "a second passivation layer located on a surface of the doped conductive layer."

Ye discloses a silicon nitride passivation layer on the solar cell's rear side. EX1004, [0038]. Based at least on *Ye*'s disclosure of the manufacturing process of the rear passivation layer, POSITAs would have understood that the rear passivation layer is located on the surface of the "heavily doped polysilicon thin film," *i.e.*, the doped conductive layer. EX1003, ¶¶102-03.

3. *Claim 3: "a shape of the polygonal plane includes at least one of a diamond, a square, a trapezoid, a substantially diamond, a substantially square or a substantially trapezoid."*

Ye discloses that the rear surface of the solar cell is textured by non-pyramid-shaped structures having polygonal top planes. EX1004, Figure 3. POSITAs would have recognized that the polygonal plane can be a diamond, a square, a trapezoid or substantially those shapes. EX1003, ¶104. Moreover, at least a number of the polygonal surfaces in Figure 3 are diamonds, squares, trapezoids, or substantially those shapes.

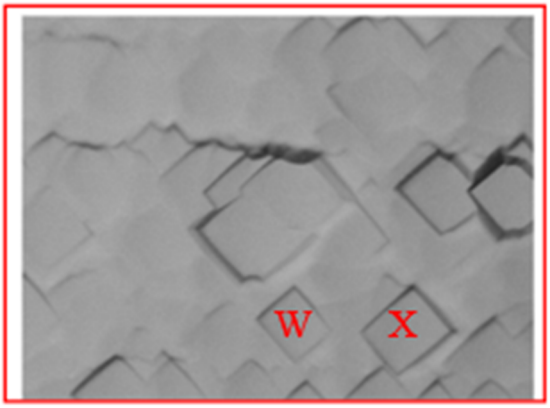


EX1004, Figure 3.

4. *Claim 5: "the first texture structure further includes two or more adjacent second substructures that do not stacked on one another, and a one-dimensional size of a top surface of the second substructure away from the rear surface is less than or equal to 45 μm."*

Ye discloses the solar cell's rear surface is textured by non-pyramid-shaped structures. EX1004, Figure 3. As shown below, at least some adjacent texture structures ("W" and "X") are not stacked on one another. *Id.* Based on the typical size and scale of most TOPCon solar cells and the textured substructures formed on

the substrates for those solar cells, POSITAs would have recognized that these top surfaces are smaller than 45 µm in any dimensional size. EX1003, ¶105.



EX1004, Figure 3 (annotated).

5. *Claim 6: "the top surface of the second substructure is a polygonal plane."*

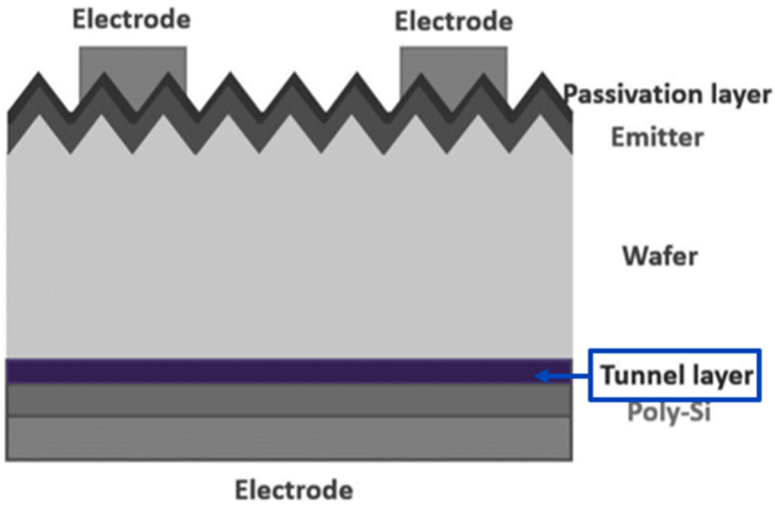
See §VII.A.4. *Ye* discloses the top surfaces of the non-pyramid substructures are polygonal planes. EX1003, ¶106.

6. *Claim 7*

a) Claim 7[a]: "the tunnel oxide layer includes at least one of a silicon oxide layer, an aluminum oxide layer, a silicon oxynitride layer, a molybdenum oxide layer or a hafnium oxide layer"

See §VII.A.2.g). *Ye* discloses "growing a silicon oxide layer … to form a tunnel-oxide passivated contact structure," which results in a silicon oxide layer as the tunnel oxide layer. EX1004, Claim 1. *Ye* also discloses "TOPCon crystalline silicon solar cell consist of … a silicon oxide passivating tunneling layer," which is

a tunnel oxide layer located on the rear texture structure of the solar cell, as shown below ("Tunnel layer"). *Id.*, [0004]; EX1003, ¶107.



EX1004, Figure 1 (annotated).

b) Claim 7[b]: "the tunnel oxide layer has a thickness ranging from 0.8 nm to 2 nm."

See §VII.A.2.g). *Ye* discloses the "thickness of the silicon oxide layer is 1.0–3.5 nm." *Id.*, Claim 3. That overlaps with the claimed thickness range and therefore presumptively discloses it and renders it obvious. EX1003, ¶¶108-09; *ClearValue, Inc. v. Pearl River Polymers, Inc.*, 668 F.3d 1340, 1345 (Fed. Cir. 2012); *UCB, Inc. v. Actavis Laboratories UT, Inc.*, 65 F.4th 679, 689-90 (Fed. Cir. 2023). Alternatively, based on this teaching, it would have been obvious to POSITAs to make *Ye*'s tunnel oxide layer with a thickness within the claimed range. EX1003, ¶¶65, 108-09.

7. *Claim 9: "the first passivation layer includes at least one of a silicon oxide layer, a silicon nitride layer, an aluminum oxide layer or a silicon oxynitride layer."*

See §VII.A.2.f). *Ye* discloses that "Al_2O_3/SiN passivation layers are formed on the front surface". EX1004, ¶0038; EX1003, ¶110.

8. *Claim 12*

a) Claim 12[a]: "the semiconductor substrate is an N-type monocrystalline silicon substrate,"

Ye discloses that the semiconductor substrate is an N-type monocrystalline silicon wafer. EX1004, [0030] ("The n-type silicon wafers used … are 180 μm-thick solar-grade Czochralski-grown monocrystalline silicon wafers …"); EX1003, ¶111.

b) Claim 12[b]: "the doped conductive layer is an N-type doped polycrystalline silicon layer, an N-type doped microcrystalline silicon layer or an N-type doped amorphous silicon layer"

See §VII.A.2.h). *Ye* discloses the doped conductive layer is an N-type doped amorphous silicon layer or an N-type doped polycrystalline conductive layer after crystallization. EX1004, ¶0007 ("a doped amorphous silicon layer is deposited by PECVD; subsequently, a high-temperature crystallization process is performed to convert the amorphous silicon into polysilicon, thereby forming a TOPCon structure"); EX1003, ¶112.

c) Claim 12[c]: "the doped conductive layer has a thickness ranging from 60 nm to 200 nm."

Ye discloses phosphorus-doped amorphous silicon thin-film layers with a thickness of 80–200 nm, and an embodiment with a thickness of 120 nm, both falling within the claimed range. EX1004, [0031], [0039] ("n^+ poly-Si (120 nm)"). POSITAs would have understood that the "n^+ poly-Si" is n-type doped polycrystalline silicon layer. EX1003, ¶113.

9. *Claim 13*

a) Claim 13[p]: "A photovoltaic module, comprising a plurality of solar cell strings, wherein each of the plurality of solar cell strings comprises solar cells, and at least one of the solar cells comprise:"

See §VII.A.2.a); EX1004, Figure 1, [0001]-[0002], [0018], [0020]-[0024], [0037]-[0038]. Moreover, POSITAs understood that, to capture enough sunlight to generate an amount of electricity sufficient for most applications, any solar cell must be used together with a plurality of cells assembled into one or more strings to form a photovoltaic module, *i.e.*, a solar panel. EX1003, ¶114; EX1015, 133 ("Typically, 1-12 cells are processed into a so-called 'string'."), 234-238. Therefore, POSITAs would have found it obvious to assemble a plurality of *Ye*'s and/or *Basu's* solar cells into a plurality of strings that form a photovoltaic module. EX1003, ¶115.

b) Claim 13[a]

See §VII.A.2.b); EX1003, ¶116.

c) Claim 13[b]

See §VII.A.2.c); EX1003, ¶117.

d) Claim 13[c]

See §VII.A.2.d); EX1003, ¶118.

e) Claim 13[d]

See §VII.A.2.e); EX1003, ¶119.

f) Claim 13[e]

See §VII.A.2.f); EX1003, ¶120.

g) Claim 13[f]

See §VII.A.2.g); EX1003, ¶121.

h) Claim 13[g]

See §VII.A.2.h); EX1003, ¶122.

a) Claim 13[h]

See §VII.A.2.i); EX1003, ¶123.

10. *Claim 15*

See §VII.A.3; EX1003, ¶125.

11. *Claim 17*

See §VII.A.4; EX1003, ¶126.

12. *Claim 18*

See §VII.A.5; EX1003, ¶127.

13. *Claim 19*

See §VII.A.6; EX1003, ¶¶128-31.

B. Ground 1A: Claims 1-3, 5-9, 12-15, and 17-20 are rendered obvious by *Ye* in view of *Basu* and *Yun*

1. *Rationale for Combining Ye, Yun,* and *Basu*

As noted above, *Ye* and *Basu* are analogous art to the '136 Patent. *Yun* also relates to the field of solar cells, and is directed to optimizing solar cell structure to improve efficiency and reduce cost (*e.g.*, by using textured surface structures on the solar cell). EX1005, [0001]-[0003]. As such, *Yun* also relates to the same field as the '136 Patent. Alternatively, *Yun* teaches how to optimize the textured surfaces on the back of the cell to improve the cell's efficiency (EX1005, [0022]), and thus also relates to problems with which the '136 Patent inventors were concerned. Therefore, *Yun* is also analogous art to the '136 Patent. EX1003, ¶¶132-34.

Ye states that, to create non-pyramid texture on the rear surface, the "backside alkaline polishing is carried out" after "boron diffusion is performed on the front surface." EX1004, [0038]. In other words, *Ye* teaches removal of material on the rear side of a TOPCon cell with chemical mechanical polishing (CMP) as an additional polishing step. EX1003, ¶¶132-34. The use of similar CMP techniques with alkaline solutions to remove material from a silicon surface often made the manufacturing process more complex and costly and created damage on the rear side. *Id.*

Yun teaches using wet chemical methods (which do not require mechanical

polishing) to remove material on the rear side of a solar cell to form platform-shaped structures of certain sizes. EX1005, [0019], [0043], [0056]. The use of wet chemical techniques to remove material from a silicon surface was well known before the '136 Patent, including for TOPCon solar cells. EX1003, ¶¶67-68, 135-136; EX1017, [0012] ("double-sided texturing" the silicon substrate to form pyramid-shaped structures (Figure 1), and then chemically etching the back side to "obtain a gentle pyramid surface" (Figure 3)).

Therefore, POSITAs would have adopted the wet chemical methods in *Yun* to remove material from the rear side of the substrate in *Ye* instead of mechanical polishing, for example, to reduce the risk of damage to rear side of the solar cell. This advantage of using wet chemical techniques over mechanical polishing was well known to POSITAs. EX1003, ¶¶135-36. That would form overlapping platform-shaped (non-pyramid) structures of the sizes claimed in the '136 patent. POSITAs would have had a reasonable expectation of success in applying the wet chemical method disclosed in *Yun* to *Ye*'s solar cells in because it uses a known method (*Yun's* wet chemical method) to obtain predictable results (i.e., forming non-pyramid textures in a manner that is less likely to cause damage to the silicon surface). EX1003, ¶¶135-36.

Based on the above, POSITAs would have combined the teachings of *Ye*, *Yun*, and *Basu* to manufacture solar cells with improved efficiency and quality. EX1003,

¶¶137-38. POSITAs would have reasonably expected that combination to successfully reach the '136 Patent's claimed invention because combining them would merely optimize different aspects of solar cells to improve the solar cell efficiency and quality, falling within routine engineering problems that POSITAs were able to solve. EX1003, ¶¶137-38.

Additionally, POSITAs would have deemed it obvious to: (1) apply the wet chemical method based on *Yun*'s teaching to create non-pyramid-shaped texture for the rear surface of the solar cell in *Ye*, and (2) further optimize the front texture pyramid height by adopting the optimal height range (~5 μm) based on *Basu*'s teaching. EX1003, ¶139. POSITAs would have motivated to make these optimizations to *Ye*'s solar cells to (1) improve the light-conversion efficiency, (2) improve the solar cell quality and yield, and (3) reduce the manufacturing cost of *Ye*'s solar cells. *Id.* POSITAs would have had a reasonable expectation of success in these optimizations since they would have involved using known methods (the wet chemical method such as that disclosed in *Yun;* the optimization of texture sizes and shapes) to obtain known results (improved efficiency, quality and reduce cost). EX1003, ¶139; *see also* §§V.A, V.B, and V.C.

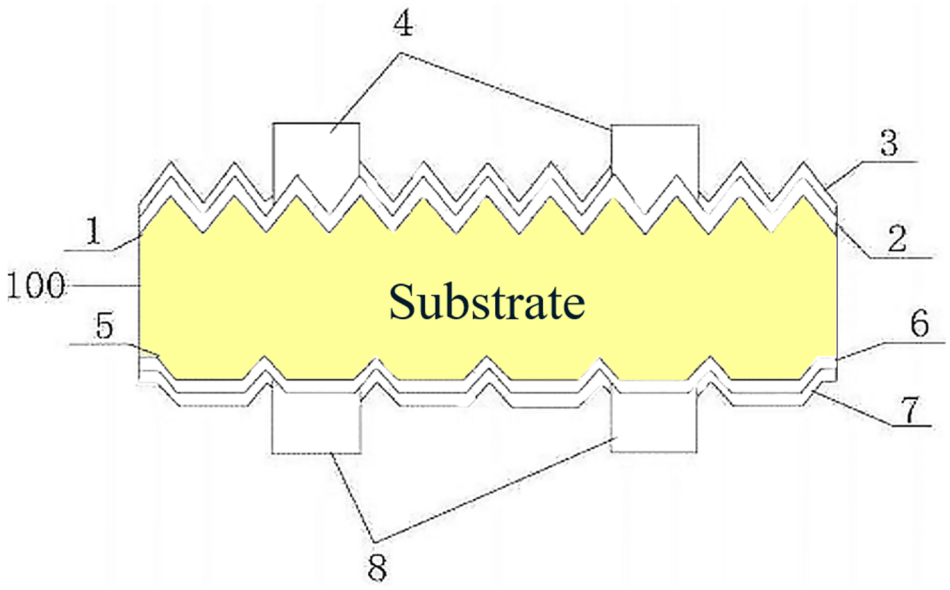
2. *Claim 1*

a) Claim 1[p]

See §VII.A.2.a). *Yun* also discloses various embodiments of "solar cells" with textured surfaces. EX1005, Abstract, Fig. 1, [0001], [0004]-[0007], [0020]-[0023], [0038], [0051] ("This invention relates to a solar cell and its preparation method …, belonging to the field of solar cell technology"); EX1003, ¶140.

b) Claim 1[a]

See §VII.B.2.b). *Yun* also discloses a monocrystalline silicon substrate (100 in Figure 1 below) that is a semiconductor substrate. EX1005, Claim 1, [0007], [0026], [0029], [0030], [0034], [0039], [0052]; EX1003, ¶141.

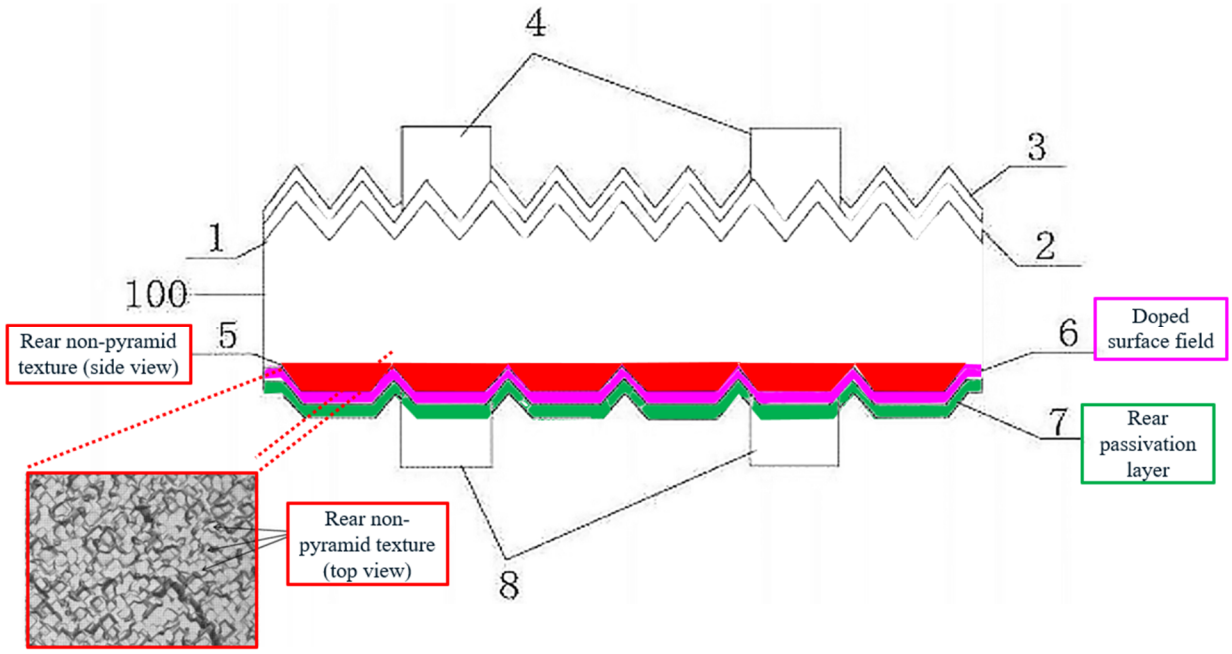


EX1005, Figure 1 (annotated).

c) Claim 1[b]

See §VII.A.2.c). *Yun* discloses solar cells having a textured rear surface with "platform-shaped substructures," which POSITAs would have understood to be

"non-pyramid-shaped substructures." EX1005, Abstract; Claim 1; [0007], [0010], [0019], [0022]-[0023], [0030], [0034], [0036], [0048] ("The back textured surface is characterized by being a platform-shaped texture surface"). Figure 2 shows a top view of the top surface of those platform shaped structures, which appear as four-sided polygonal planar surfaces located on the rear surface of the solar cell.



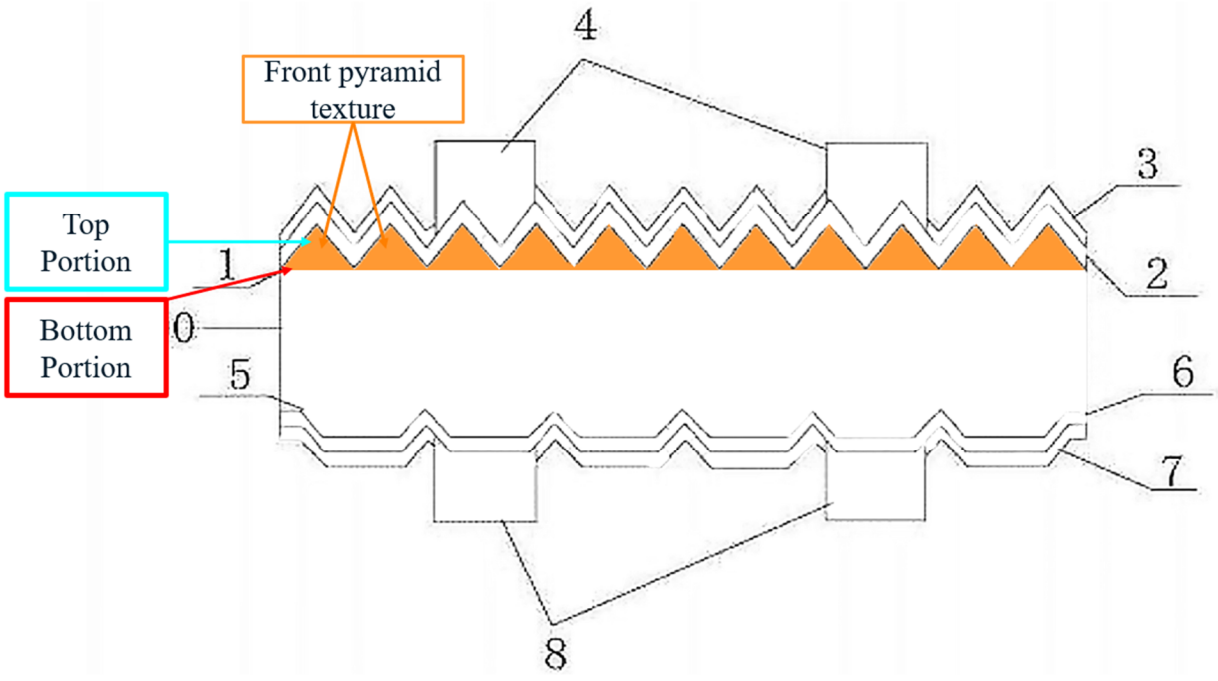
EX1005, Figures 1-2 (annotated).

Yun further discloses "[t]he platform structures are … partially overlapping …," which POSITAs would have understood to mean that the platform structures (non-pyramid substructures) are at least partially stacked on one another. EX1005, Abstract, [0010], [0029]; EX1003, ¶¶142-43. Furthermore, *Yun* discloses "[e]ach platform structure has a lower plane connected to the silicon substate and an upper plane opposite to the lower plane," and "the side length of the upper plane is

2 to 10 μm," which means the top surface of each platform-shaped substructures has a one-dimensional size less than 45 μm. EX1005, Abstract; EX1003, ¶¶142-44. Therefore, at least the combination of *Ye* and *Yun* discloses claim 1[b]..

d) Claim 1[c]

See §VII.A.2.d). *Yun* also discloses that the substrate's front surface has pyramid-shaped texture structures. EX1005, [0003], [0029] ("a front-side pyramidal texturing surface"); [0034] ("a front pyramid-shaped texture surface 1"). POSITAs would have understood that the front pyramid-shaped texture structure has a top portion away from the substrate and a bottom portion close to the substrate. EX1003, ¶145.



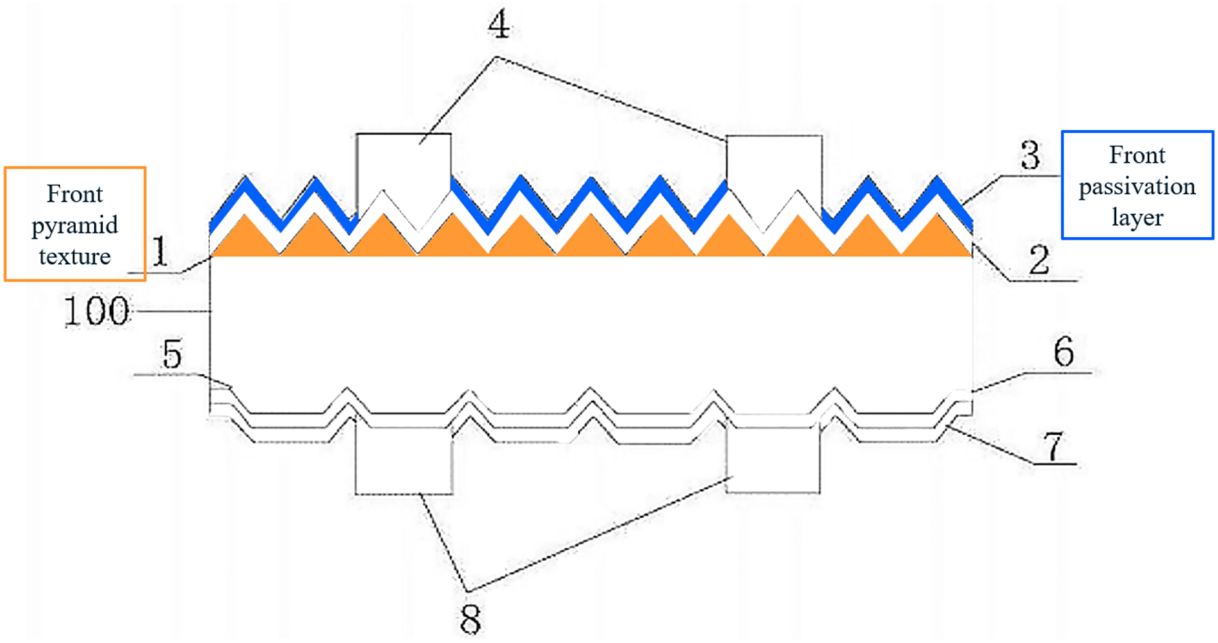
EX1005, Figure 1 (annotated).

e) Claim 1[d]

See §VII.A.2.e). EX1003, ¶146.

f) Claim 1[e]

See §VII.A.2.f). *Yun* also discloses that the solar cell has "a front passivation antireflection dielectric layer (3)" located on "a front PN emitter junction (2)". EX1005, Abstract, Claims 1-2, [0007]-[0008], [0026], [0029]-[0036].



EX1005, Figure 1 (annotated).

As discussed in Ground 1, based on Patent Owner's interpretation in its patent infringement complaint, the front passivation antireflection dielectric layer 3 of *Yun*,

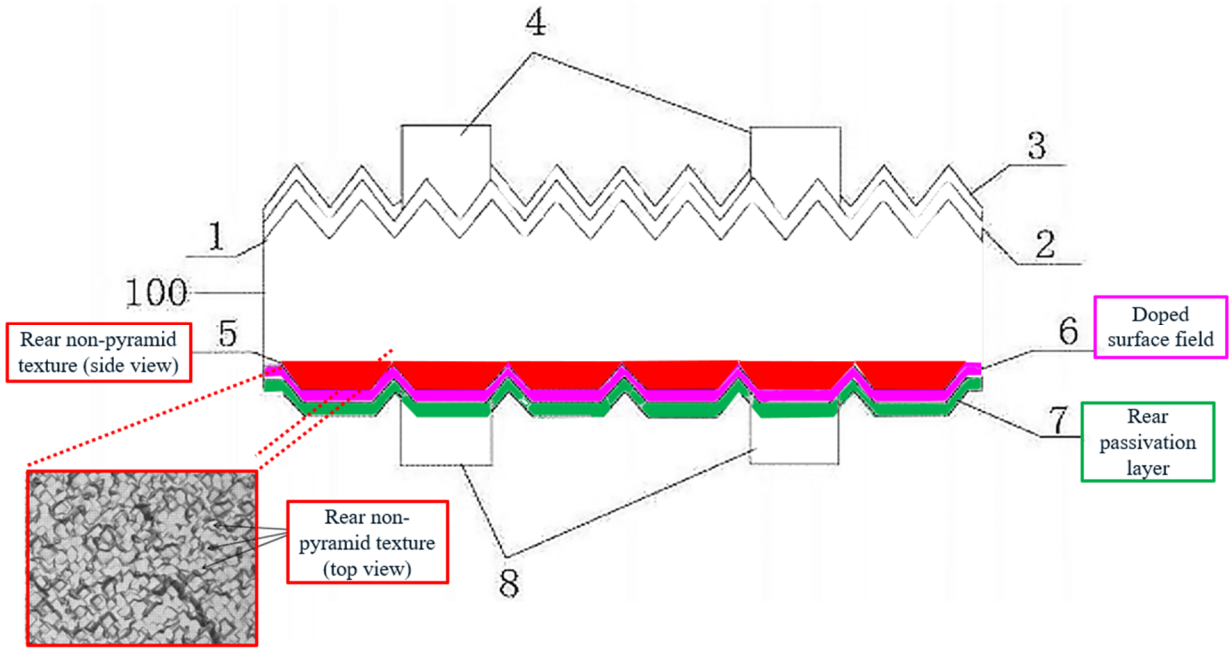
either alone or in combination with the front PN emitter junction 2, discloses this requirement of claim 1[e].[7] EX1003, ¶¶147-148.

g) Claim 1[f]

See §VII.A.2.g); EX1003, ¶149.

h) Claim 1[g]

See §VII.A.2.h); EX1003, ¶150; *see also* EX1005, [0034] ("… a phosphorus-doped back surface field 6 formed by back phosphorus doping …"), Fig. 1 (pink below).

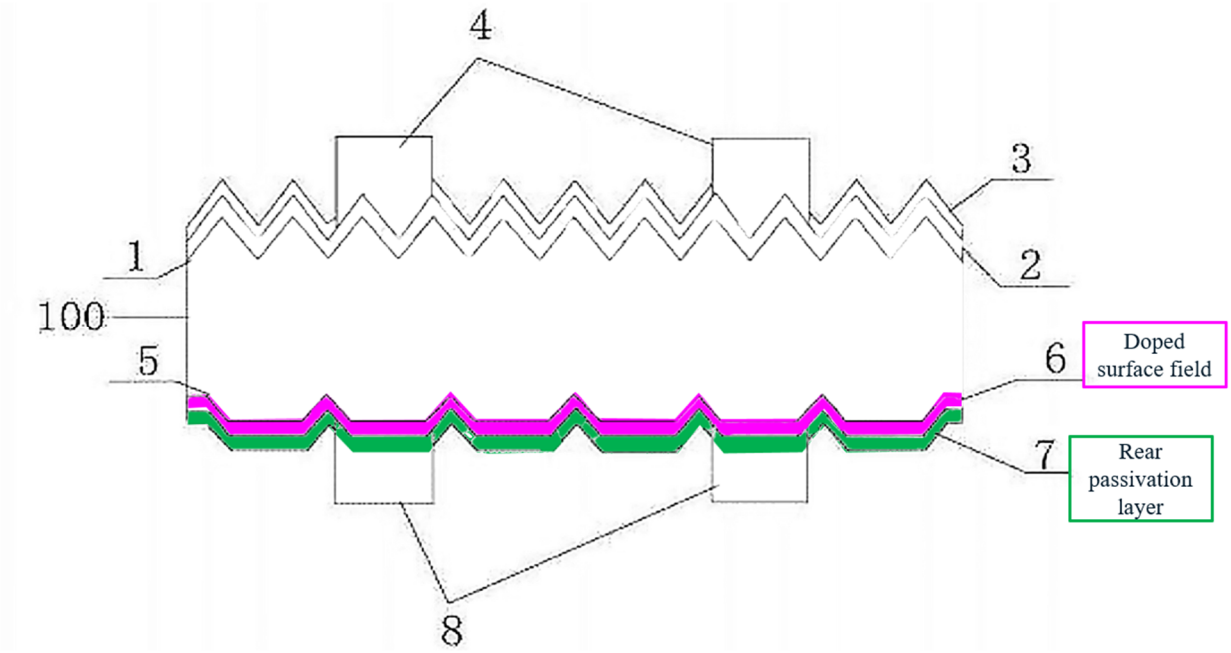


EX1005, Figure 1 (annotated).

[7] If the Board does not adopt Patent Owner's interpretation, as discussed in Ground 6, *Sakai* discloses this requirement under any plausible construction.

i) Claim 1[h]

See §VII.A.2.i); EX1003, ¶151; *see also* EX1005, [0029]-[0030] ("back passivation antireflection dielectric layer 7"), Fig. 1 (green below).

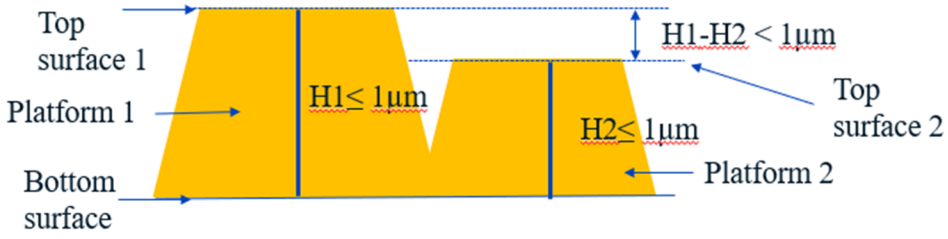


EX1005, Figure 1 (annotated).

3. ***Claim 2: "for the two or more first substructures at least partially stacked on one another, in the direction away from the rear surface and perpendicular to the rear surface, a distance between the top surface of the outermost first substructure and the top surface of the adjacent first substructure is equal to or less than 2 μm."***

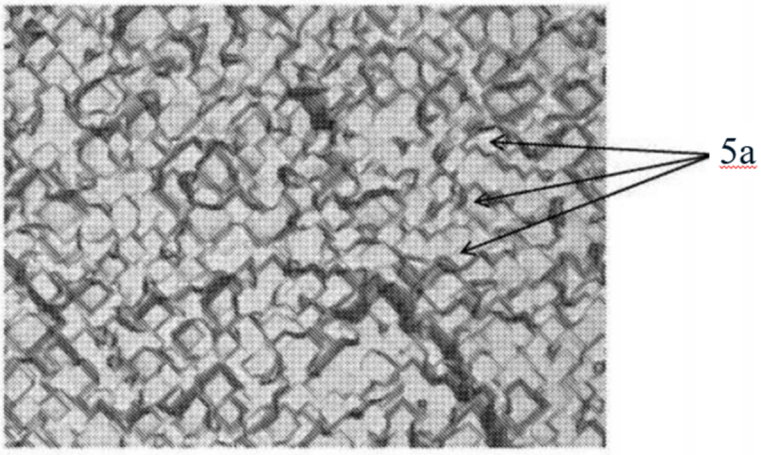
Yun discloses the cell's rear surface has platform-shaped texture and "the height of the platform structure 5a is 1 μm." EX1005, [0030]. POSITAs would have understood that when all platform-shaped structures have heights (H1, H2 below) less than 1 μm with respect to the same surface of the solar cell, the distance between

top surfaces (*i.e.*, H1-H2) of any two platform-shaped structures would be less than 1 μm, which reads on claim 2. EX1003, ¶152.



4. *Claim 3*

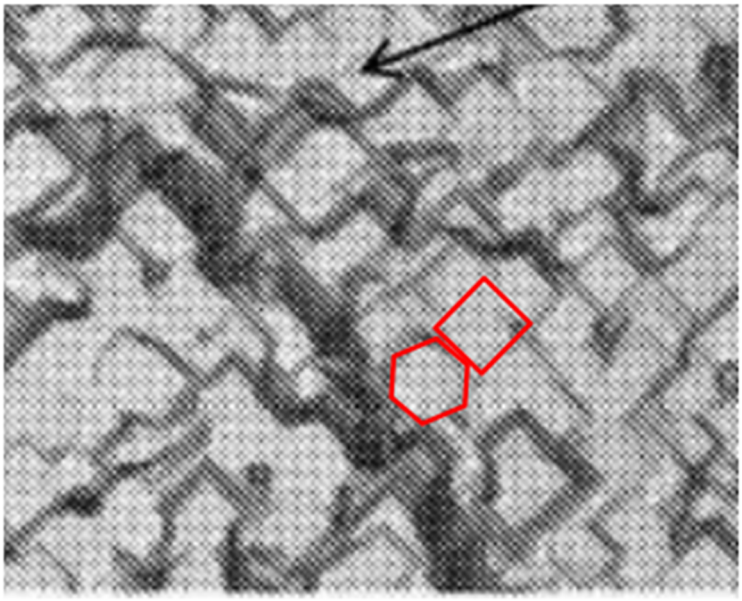
See §VII.A.3. *Yun* also discloses that the cell's rear surface is textured by platform-shaped (non-pyramid-shaped) structures, which have polygonal top planes. EX1005, Figure 2. POSITAs would have recognized that the polygonal plane can be a diamond, a square, a trapezoid or a substantial those shapes. EX1003, ¶153. Moreover, at least some of the polygonal surfaces in Figure 2 are diamonds, squares, trapezoids, or substantially one of those shapes.



EX1005, Figure 2 (top view).

5. *Claim 5*

See §VII.A.4. *Yun* also discloses the solar cell has a textured rear surface with "platform-shaped substructures," which POSITAs would have understood are "non-pyramid-shaped substructures." EX1005, Abstract, Claim 1, Figures 1-2; EX1003, ¶¶154-55. *Yun* also describes that the rear surface platform structures may be "dispersed," "flat," or "partially connected." *Id.*, [0007]. Each of these terms indicates that the bottoms of adjacent platform structures do not overlap each other. EX1005, [0010]. POSITAs would understand this disclosure as describing platform structures that are not stacked on one another. EX1003, ¶154. Moreover, as shown below, the highlighted platform-shaped substructures do not stack on one another.



EX1005, Figure 2 (annotated).

Furthermore, *Yun* discloses "[e]ach platform structure has a lower plane connected to the silicon substate and an upper plane opposite to the lower plane," and "the side length of the upper plan is 2 to 10 μm," which means that the top surface of each platform-shaped substructure has a one-dimensional size less than 45 μm. *Id.*, Abstract; EX1003, ¶155.

6. *Claim 6*

See §VII.A.5, §VII.B.5. *Yun* discloses that the top surfaces of the non-pyramid substructures are polygonal planes. EX1005, Figure 2; EX1003, ¶156.

7. *Claim 7*

See §VII.A.6; §VII.B.2.g). EX1003, ¶¶157-158.

8. *Claim 8*

a) Claim 8[a]: "the second passivation layer includes at least one of a silicon nitride layer, a silicon oxide layer or a silicon oxynitride layer,"

Ye discloses that the passivation layer on the rear surface is "a SiN passivation layer." EX1004, ¶0038. *Yun* discloses that the front passivation antireflection dielectric layer 3 and the back passivation antireflection dielectric layer 7 are respectively composed of single-layer film or multi-layer film, which can be "made of silicon oxide, silicon nitride, silicon oxynitride …," amongst other things. EX1005, Claim 2. EX1003, ¶159.

b) Claim 8[b]: "the second passivation layer has a thickness ranging from 70 nm to 120 nm."

Ye is silent on the thickness of the passivation layer on the rear surface. However, *Yun* discloses that "the back passivation antireflection dielectric layer 7 is a single layer film made of silicon nitride, with a film thickness of 70 to 80 nm," which falls within the claimed range. EX1005, [0034]; *see also id.* [0030], [0046] (front passivation antireflection dielectric layer 3 "is a single-layer film made of silicon nitride with a thickness of 70 to 80 nm."). *Ye*'s and *Yun's* rear passivation layers are made of the same silicon nitride material and perform the same function, *i.e.*, passivating the cell's rear surface. EX1003, ¶¶64, 160; *see also* EX1024, 967 ("SiNx film as AR coating as well as a surface passivation layer plays and important role in commercial mc-Si solar cells"); EX1025, 2326 ("SiNx:H ARC is often deposited after texturing in order to increase light collection and to passivate silicon surface"). Therefore, POSITAs would have found it obvious to make the passivation layer on the rear surface of *Ye's* cell to have a thickness in the range disclosed for *Yun's* rear passivation layer. EX1003, ¶160.

9. *Claim 9*

See §VII.A.7; §VII.B.2.f). EX1003, ¶161.

10.*Claim 12*

a) Claim 12[a]

See §VII.A.8.a). *Yun* also discloses that the semiconductor wafer (substrate) is an "N-type single-crystal silicon". EX1005, [0034]. POSITAs would have understood that is "an N-type monocrystalline silicon substrate." EX1003, ¶162.

b) Claim 12[b]

See §VII.A.8.b), §VII.B.2.h). Furthermore, *Yun* discloses "amorphous silicon" and "microcrystalline silicon" as permissible materials for the front and rear passivation layers. EX1005, Claim 2. POSITAs would have understood that the rear doped conductive layer can be N-type doped microcrystalline silicon layer or an N-type doped amorphous silicon layer. EX1003, ¶163.

c) Claim 12[c]

See §VII.A.8.c), §VII.B.2.h); EX1003, ¶164.

11.*Claim 13*

a) Claim 13[p]

See §VII.A.9.a). *Yun* also discloses a "photovoltaic power generation system based on bifacial solar cells." EX1005, [0002]. POSITAs would have understood that the "photovoltaic power generation system based on bifacial solar cells" would correspond to a module with a plurality of solar cells or solar cell strings. EX1003, ¶165.

b) Claim 13[a]

See §VII.B.2.b); EX1003, ¶166.

c) Claim 13[b]

See §VII.B.2.c); EX1003, ¶167.

d) Claim 13[c]

See §VII.B.2.d); EX1003, ¶168.

e) Claim 13[d]

See §VII.B.2.e); EX1003, ¶169.

f) Claim 13[e]

See §VII.B.2.f); EX1003, ¶170.

g) Claim 13[f]

See §VII.B.2.g); EX1003, ¶171.

h) Claim 13[g]

See §VII.B.2.h); EX1003, ¶172.

a) Claim 13[h]

See §VII.B.2.i); EX1003, ¶173.

12. *Claim 14*

See §VII.B.3; EX1003, ¶174.

13. *Claim 15*

See §VII.B.4; EX1003, ¶175.

14. *Claim 17*

See §VII.B.5; EX1003, ¶176.

15. *Claim 18*

See §VII.B.6; EX1003, ¶177.

16.*Claim 19*

See §VII.B.7; EX1003, ¶¶178-179.

17.*Claim 20*

See §VII.B.8; EX1003, ¶¶180-181.

C. Ground 2: Claims 2, 5, 6, 14, 17, and 18 are rendered obvious by *Ye* in view of *Basu* and *Xia*.

1. *Rationale for Combining Ye, Basu, and Xia*

Xia relates to optimizing solar cell design, and specifically is concerned with improving existing alkaline-based methods for polishing crystalline silicon surfaces of solar cells (including TOPCon cells), which improves the cell's conversion efficiency. EX1006, [0001]-[0002], [0055]. Therefore, *Xia* is in the same field as the '136 Patent and concerns the same problem of optimizing the cell's texture surfaces to improve its efficiency. Thus, *Xia* is analogous art to the '136 Patent. EX1003, ¶182.

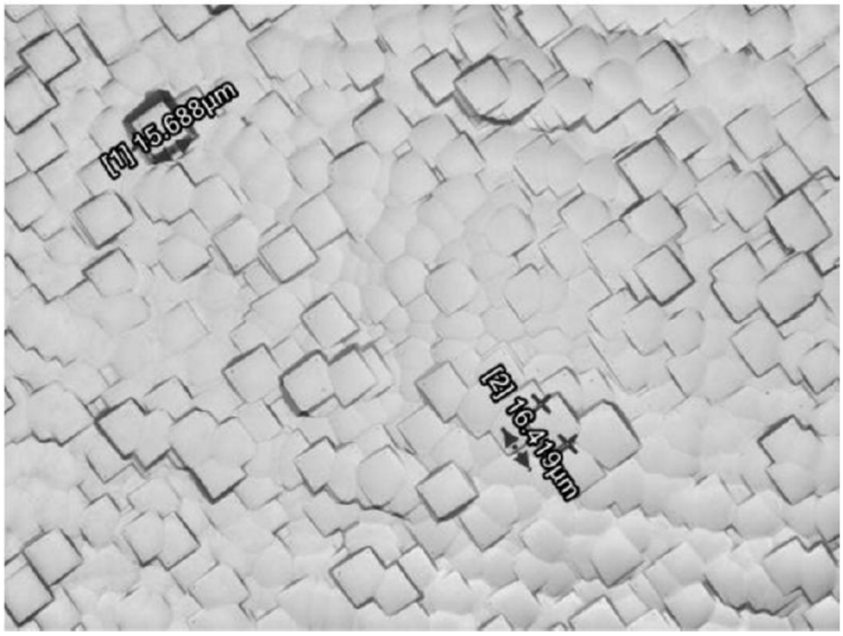
Ye describes that, to reduce the sheet resistance of the polysilicon thin-film layer, the amorphous silicon films should be thicker. EX1004, [0008]. However, thicker films are prone to delamination, which deteriorates passivation. *Id. Ye* addresses this problem with an improved process for preparing the laminated thin-film passivated contact structure. *Id.*, [0011]-[0015], [0020]. *Xia* describes a method of polishing the silicon wafer surface that "can effectively improve the uniformity

of the back passivation coating and improve the passivation effect." EX1006, [0002]. As discussed earlier, *Ye* teaches the importance of good adhesion between the silicon oxide layer and subsequent thin films to prevent delamination. EX1004, [0020]. As such, POSITAs would recognize that a smoother, more uniform substrate per *Xia* would provide a better foundation for *Ye*'s laminated film structure. EX1003, ¶183.

Since *Xia* and *Ye*'s methods generally use similar types of processes for manufacturing TOPCon solar cells and compatible N-type monocrystalline silicon wafers and target similar solar cell architectures, POSITAs would reasonably expect that the combination of *Xia* and *Ye* would succeed. EX1003, ¶¶184-85. Therefore, POSITAs would have been motivated to combine the teachings of *Ye*, *Basu*, and *Xia* to manufacture solar cells with improved quality. EX1003, ¶¶184-85.

2. *Claims 2 and 14*

Xia discloses silicon wafers having a surface roughness of about 10-20 μm and that pre-polishing can reduce it to 1-3 μm. EX1006, [0007]. Figure 1 is a microscope photograph of the polished surface on the wafer's rear side.



EX1006, Figure 1. That surface has at least some non-pyramid substructures that, at least based on Patent Owner's interpretation of the '136 Patent claims, are stacked on one another. EX1003, ¶186. *Xia* discloses that "[t]he silicon wafer obtained after polishing has high surface flatness and few surface defects." *Id.*, [0024]. POSITAs would have understood these teachings to disclose polishing the rear wafer surface such that the distance away from and perpendicular to the rear substrate surface between the top surface of the outermost first substructure and the top surface of the adjacent first substructure would be equal to or less than 2 µm. EX1003, ¶186.

3. *Claims 5 and 17*

See §VII.C.2. The polished surface on the wafer's rear side has "uniform and smooth square structures" with approximately the same size of about 15 to 16 µm. EX1006, [0033]. As shown in Figure 1 above, the polished surface further has two

or more adjacent second substructures that are not stacked on one another. Figure 1 also shows that the one-dimensional size of a top surface of the substructure away from the rear wafer surface is less than 45 μm. *See* EX1003, ¶187.

4. *Claims 6 and 18*

See §VII.C.3. Figure 1 of *Xia* shows the rear wafer surface has substructures with their top surfaces being polygonal (*e.g.*, substantially square and other polygonal shapes). *See* EX1003, ¶188.

D. Ground 3: Claims 7, 9, and 19 are rendered obvious by *Ye* in view of *Basu*, and *Chang*

1. *Rationale for Combining Ye, Basu, and Chang*

Chang discloses TOPCon solar cells with optimized and improved efficiency. EX1023, Abstract, 1:16-20. *Chang* addresses the problem of avoiding defects and damage on the back surface of the semiconductor substrate (*i.e.*, by optimizing the tunnel oxide layer on the back surface) to improve the cell's efficiency. EX1023, 1:45-2:3. Therefore, *Chang* is in the same field as the '136 Patent and also concerns the same problem as the '136 Patent. *Chang* is analogous art to the '136 Patent. EX1003, ¶189.

Like *Ye*, *Chang* teaches TOPCon solar cells having rear tunneling layers on a silicon substrate to enable passivation and carrier tunneling. EX1004, [0004]; EX1023, 5:22-28, 5:30-334, 7:8-15. In both references, a rear polySi back surface

field is formed on the tunneling layer. *Id.* And in both references, the passivation / antireflective films may include dielectrics such as Al2O3, HfO2, SiOx, SiNx, and SiON, and the tunneling layers can be formed by similar methods. EX1004, Abstract, [0038]; EX1023, 5:22-28, 5:30-33, 6:30-37, 7:8-15; EX1003, ¶¶65, 190-92. At least because of these similarities, POSITAs would be motivated to combine *Chang* with *Ye* to create solar cells with improved quality and mechanical strength. Moreover, POSITAs would have recognized that thickness of tunneling layers is a result-effective variable and optimizing that thickness is a routine engineering problem in solar cell design and manufacturing. EX1003, ¶¶190-92. Therefore, POSITAs would have a reasonable expectation of success in combining *Chang* with *Ye* based on these similarities and routine optimization processes. EX1003, ¶¶190-92.

2. *Claims 7 and 19*

a) Claim 7[a] and 19[a]

See §VII.A.6.a). *Chang* also teaches rear tunneling layers on a silicon substrate to enable passivation and carrier tunneling, specifying materials including silicon oxide, silicon nitride, and silicon oxynitride. EX1023, 5:22-28; 5:30-33; 7:8-15. A rear polySi back surface field is formed on the tunneling layer, while passivation/antireflective films may include dielectrics such as Al2O3, HfO2, SiOx, SiNx, and SiON, and the tunneling layers can be formed by thermal growth, PECVD, or ALD. *Id.* As such, *Chang* discloses claim 7[a]. EX1003, ¶193.

b) Claim 7[b] and 19[b]

See §VII.A.6.b). *Chang* teaches rear tunneling layers including silicon oxide, silicon nitride, and silicon oxynitride with a tunneling layer thickness range of 0.5–2 nm (more generally 0.5–5.0 nm). EX1023, 5:21-27; 5:30-34; 7:8-15. That encompasses the claimed thickness range and therefore presumptively discloses it and renders it obvious. EX1003, ¶194-95; *ClearValue*, 668 F.3d at 1345; *UCB*, 65 F.4th at 689-90. Alternatively, based on this teaching, it would have been obvious to POSITAs to make *Ye*'s tunnel oxide layer having a thickness within the claimed range. EX1003, ¶¶194-95.

3. *Claim 9*

See §VII.A.7. *Chang* discloses "first passivation film 21" as including SiNx (silicon nitride), hydrogenated SiNx, SiOx (silicon oxide), SiON (silicon oxynitride), or Al2O3 (aluminum oxide). EX1023, 6:30-37; *see* EX1003, ¶196.

E. Ground 3A: Claims 7, 9, and 19 are rendered obvious by *Ye* in view of *Basu*, *Yun*, and *Chang*

For the same reasons discussed in Grounds 1A and 3, POSITAs would have found it obvious to combine *Ye*, *Basu*, *Yun*, and *Chang*. EX1003, ¶197. Moreover, as discussed in Grounds 1A and 2, *Ye* in view of *Basu*, *Yun*, and *Chang* renders Claims 7, 9, and 19 obvious. EX1003, ¶198.

F. Ground 4: Claim 10 is rendered obvious by *Ye* in view of *Basu* and *Yu*

1. *Rationale for Combining Ye, Basu, and Yu*

Like the ’136 Patent, *Yu* also relates to the field of solar cells, and more specifically to optimizing the design of a TOPCon solar cell to improve its conversion efficiency. EX1016, Abstract. As such, *Yu* is analogous art to the ’136 Patent. EX1003, ¶199.

Ye describes TOPCon solar cells having a textured front side that is passivated with Al_2O_3/SiN layers formed on the front surface, but is silent on the thicknesses of those layers. *Yu* states that it “focuses on the optimized design of the front surface TOPCon layer” of a bifacial TOPCon solar cell and the performance of the solar cell based on that optimization. Part of that optimization of the front surface includes the use of a front side passivation layer. *Yu*’s front side passivation layer is also a bilayer film made of the same sublayers and materials disclosed in *Ye*. As noted below, such sequential stacks were also well known in passivation layers in solar cells before the ’136 Patent. EX1003, ¶¶200, 215. Therefore, POSITAs would have considered *Yu*’s front side passivation layer to be substantially similar to *Ye*’s and thus would have considered *Yu*’s teachings regarding the structure and thickness of the Al_2O_3/SiN sublayers in designing *Ye*’s front passivation layer. EX1003, ¶¶64, 200.

Moreover, POSITAs would have been motivated to make *Ye*’s or *Yun’s* aluminum oxide layer as thin as possible while still providing effective passivation, *e.g.*, to reduce the amount of materials needed for manufacturing and minimize the size and weight of the solar cell. EX1003, ¶201. And *Yu* teaches that an aluminum

oxide layer as thin as 5 nm was effective to passivate the front side of the solar cell. *Id.* Passivation layers composed of bilayer films with aluminum oxide layers of this thickness also were well known to POSITAs. EX1003, ¶201; EX1034, [0085] (composite passivation films that include aluminum oxide sublayers 5-15 nm thick); EX1039, 10:22-31 (aluminum oxide layer 17 with thickness of 4-20 nm, specifying 5 and 10 nm as examples); EX1035 at 97 (10 nm thick aluminum oxide layer additionally coated with 50 nm silicon nitride and 90 nm MgF_2); EX1036, Figure 2, [0032] (n-type PERT solar cell having "a laminated passivation layer consisting of aluminum oxide and silicon nitride," with aluminum oxide thickness of about 5 nm); *see also* EX1015, 96-100.

POSITAs would have had a reasonable expectation of success in using the thicknesses of the front passivation sublayers disclosed in *Yu* for the solar cells in *Ye* because it uses a known method (thicknesses of *Yu*'s Al_2O_3/SiN bilayer film) to obtain predictable results (i.e., forming a passivation layer for the front surface of a TOPCon solar cell). EX1003, ¶202.

2. *Claim 10*

a) Claim 10[a]: "the first passivation layer is a stacked passivation structure of an aluminum oxide layer and a silicon nitride layer,"

See §VII.A.2.f). *Yu* describes fabricating TOPCon solar cells in which the cell's front side "was passivated by 5 nm AlOx and 75 nm SiNx." EX1016, 3 (§2.2.1,

solar cell "with front conventional n-PERT structure and rear TOPCon structure); *see also id.*, 4 (§2.2.2, similar layers on front selective and rear total TOPCon structure). As shown in Figure 4, the silicon nitride sublayer (SiNx, blue below) is stacked on top of the aluminum oxide sublayer (Al2O3, yellow below).

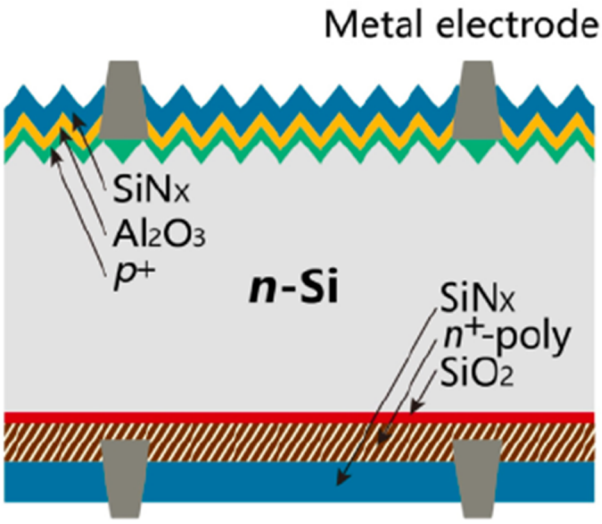


Fig. 4. Solar cell con

Therefore, *Yu* discloses a stacked passivation structure with an aluminum oxide layer under a silicon nitride layer. POSITAs would have found it obvious to use a similar stack of aluminum oxide and silicon nitride sublayers in *Ye*'s front passivation layer. EX1003, ¶¶203-04.

b) Claim 10[b]: "the aluminum oxide layer has a thickness ranging from 2 nm to 10 nm, and"

The AlOx sublayer of *Yu*'s passivation layer has a thickness of 5 nm, which falls within the claimed range. EX1016, 3-4. In view of *Yu*'s teachings, POSITAs

would have found it obvious to make the aluminum oxide layer in *Ye*'s front passivation layer of the same or similar thickness as *Yu's* within the claimed range. EX1003, ¶205.

c) Claim 10[c]: "the silicon nitride layer has a thickness ranging from 50 nm to 110 nm."

The SiNx sublayer of *Yu*'s passivation layer has a thickness of 75 nm, which falls within the claimed range. EX1016, 3-4. In view of *Yu*'s teachings, POSITAs would have found it obvious to make the silicon nitride layer in *Ye*'s front passivation layer of the same or similar thickness as *Yu* within the claimed range. EX1003, ¶206.

G. Ground 4A: Claim 10 is rendered obvious by *Ye* in view of *Basu*, *Yun*, and *Yu*

1. *Rationale for Combining Ye, Basu, Yun, and Yu*

Similar to *Ye*, *Yun* describes solar cells having front passivation layers comprised of, for example, aluminum oxide and silicon nitride. EX1005, [0034]. *Yun* gives ranges of thicknesses for those sublayers, and the aluminum oxide sublayer is slightly thicker than claim 10's range. POSITAs would have been motivated to make *Ye*'s or *Yun's* aluminum oxide layer of the thicknesses described in *Yu* for the same reasons discussed in §VII.F.1. POSITAs would have had a reasonable expectation of success in doing so for similar reasons. EX1003, ¶¶207-11.

2. *Claim 10*

See §VII.F.2; EX1003, ¶¶212-26.[8]

H. Ground 5: Claim 11 is rendered obvious by *Ye* in view of *Basu* and *Fang*

1. *Rationale for Combining Ye, Basu, and Fang*

Fang also relates to the field of solar cells, and more specifically to solar cells having a high photoelectric conversion efficiency and high appearance quality. EX1034, [0010]-[0011]. Therefore, *Fang* relates to the same field as the '136 Patent, and is therefore analogous art. EX1003, ¶227.

Ye describes TOPCon solar cells having a textured front side that is passivated with Al_2O_3/SiN passivation layers formed on the front surface, but is silent on their thicknesses or whether additional passivating layers may be on the front surface. Passivation layers comprised of stacks of sublayers were well known to POSITAs, and it was well known that the performance of such passivation layers could be enhanced by adjusting the composition, thicknesses, and other properties of the sublayers. EX1003, ¶229; EX1034, [0085]; EX1039, 10:22-31; EX1035 at 97;

[8] Regarding claim 10[b], to the extent making *Yun's* aluminum oxide layer thinner might make its overall front passivation layer thinner than the lower end of *Yun*'s total range, POSITAs would have made any appropriate adjustments. EX1003, ¶214.

EX1036, Figure 2, [0032]; EX1015, 96-100 (discussing antireflective coatings). *Fang* describes an improved PECVD process to form composite passivation films having sublayers of different compositions and thicknesses. EX1034, [0148]. *Fang* also teaches that its preparation method is simple, flexible, and compatible with existing production lines and that, using its methods, the rear composite film "gives the best passivation effect and significantly increases the photoelectric conversion efficiency of the PERC cell." *Id.*, [0148], [0152]. *Fang* also discloses that the film's sublayers are made of similar materials and perform similar functions as *Ye's* front passivation layer. *Id.*, [0077], [0081]; EX1003, ¶¶229-30. Therefore, POSITAs would be motivated to use *Fang*'s teachings regarding its rear composite films to optimize the passivation effect of *Ye's* front passivation layers. EX1003, ¶230. POSITAs would have had a reasonable expectation of success in doing so because it uses a known method (forming a composite passivation film) to obtain predictable results (passivation in a solar cell). EX1003, ¶231

2. *Claim 11*

a) Claim 11[a]: "the first passivation layer is a stacked passivation structure of an aluminum oxide layer, a silicon nitride layer and a silicon oxynitride layer sequentially stacked,"

See §VII.A.2.f). *Fang* discloses that the rear passivation film in Figure 3 includes a bottom aluminum oxide layer 31, and a "top layer 32 [that] is composed of a silicon oxynitride film and a silicon nitride film." EX1034, [0078].

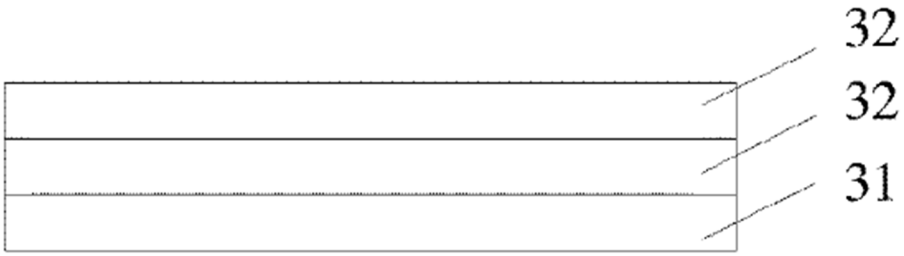


FIG. 3

EX1034, Fig. 3. Although *Fang* does not expressly specify the order of the silicon nitride and silicon oxynitride films 32, *Fang* states that "***[t]he combination order***, thickness, and composition of the composite film ***can be flexibly adjusted***." *Id*., [0134] (emphasis added). Therefore, POSITAs would have understood *Fang* to teach providing the silicon nitride layer on top of the aluminum oxide layer and the silicon oxynitride layer on top of that. EX1003, ¶232. In view of *Fang*'s teachings, that order also would have been obvious to try as one of only two possible sequences for those layers. *Id*. Therefore, POSITAs would have found it obvious to use *Fang*'s rear composite film of Figure 3 in place of *Ye*'s front passivation layer, or to modify *Ye*'s passivation layer to include the sublayers described above sequentially stacked as in *Fang*. EX1003, ¶233.

b) Claim 11[b]: "the aluminum oxide layer has a thickness ranging from 2 nm to 10 nm,"

Fang discloses the aluminum oxide layer has a thickness of 5-15 nm, which overlaps the claimed range and therefore presumptively discloses it and renders it

obvious. EX1034, [0085]; EX1003, ¶234; *ClearValue*, 668 F.3d at 1345; *UCB*, 65 F.4th at 689-90. Moreover, as discussed in §VII.F.1 and §VII.H.1, several references taught composite passivation layers having an aluminum oxide sublayer with a thickness in the claimed range, and therefore it was within POSITAs' skill to select a thickness within the claimed range. EX1003, ¶237. Finally, POSITAs would recognize that the aluminum oxide layer's thickness is a result-effective variable and may be optimized to improve passivation properties such as surface chemical passivation, optical anti-reflection characteristics, and electronic passivation. EX1003, ¶¶234-37; EX1015, 96-100 (discussing antireflective coatings). Such optimizations were routine engineering tasks for POSITAs designing a solar cell. *Id.*

Therefore, POSITAs would have understood *Fang* to teach and render obvious a thickness for the aluminum oxide layer (and, similarly, for the aluminum oxide layer in *Ye's* front passivation layer) within the claimed range. EX1003, ¶238.

c) Claim 11[c]: "the silicon nitride layer has a thickness ranging from 40 nm to 80 nm, and"

Fang discloses that the silicon nitride layer has a thickness of 50-150 nm, which overlaps the claimed range and therefore presumptively discloses it and renders it obvious. EX1034, [0085]; EX1003, ¶239; *ClearValue*, 668 F.3d at 1345; *UCB*, 65 F.4th at 689-90. Moreover, several references taught composite passivation layers that include a silicon nitride sublayer of a thickness in the claimed range, and

therefore it was within POSITAs' skill to select a thickness within the claimed range. EX1003, ¶¶239-41; EX1036, [0032] (silicon nitride thickness of about 75 nm); EX1016, 3-4 (similar); EX1035, 97 (50 nm silicon nitride); EX1039, 8:40-9:9 (disclosing various thickness ranges). Finally, POSITAs would recognize that the thickness of the aluminum oxide layer is a result-effective variable that may be optimized to improve passivation properties. EX1003, ¶¶239-41. Such optimizations were routine engineering tasks for POSITAs designing a solar cell. EX1003, ¶240; EX1015, 96-100 (discussing antireflective coatings).

Therefore, POSITAs would have found it obvious to choose a thickness for *Fang's* silicon nitride layer (and, similarly, for the silicon nitride layer in *Ye's* front passivation layer) within the claimed range. EX1003, ¶241.

d) Claim 11[d]: "the silicon oxynitride layer has a thickness ranging from 10 nm to 60 nm."

Fang discloses that the silicon oxynitride layer has a thickness of 5-20 nm, which overlaps the claimed range and therefore presumptively discloses it and renders it obvious. EX1034, [0085]; EX1003, ¶242; *ClearValue*, 668 F.3d at 1345; *UCB*, 65 F.4th at 689-90. POSITAs also would have recognized that the thickness of the silicon oxynitride layer is a result effective variable and may be optimized to improve passivation properties. EX1003, ¶242. Such optimizations were routine engineering tasks for POSITAs designing a solar cell. EX1003, ¶243; EX1015, 96-

100. Moreover, silicon oxynitride layers with thicknesses in the claimed range were well known in the art. EX1003, ¶244; EX1039, 6:65-7:8. Therefore, POSITAs would have found it obvious to use in *Ye* a front passivation stack like *Fang*'s rear composite film that includes an oxynitride layer of the disclosed thickness, or to add a silicon oxynitride layer of that thickness on top of *Ye*'s existing Al_2O_3/SiN front passivation layers, to optimize the passivation effect. EX1003, ¶¶243-45.

I. Ground 5A: Claim 11 is rendered obvious by *Ye* in view of *Basu*, *Yun* and *Fang*

1. *Rationale for Combining Ye, Basu, Yun, and Fang*

Yun describes solar cells having a front passivation layer "composed of single layer film or multilayer film made of silicon oxide, silicon nitride, silicon oxynitride, aluminum oxide …." EX1005, Claim 2. For passivation layers comprising a bilayer of silicon nitride and aluminum oxide, *Yun* gives ranges of thicknesses for those sublayers but is silent where the passivation layer comprises more than 2 sublayers.

Therefore, POSITAs would be motivated to use *Fang*'s teachings regarding its rear composite films to optimize the passivation effect of the front passivation layers on *Ye*'s and *Yun's* cells for the same reasons discussed in §VII.H.1. EX1003, §XIX.A. And POSITAs would have had a reasonable expectation of success in applying *Fang*'s teachings regarding the sublayers and thicknesses of the rear composite film disclosed to the front passivation layer of the solar cells in *Ye* and *Yun* for similar reasons. *Id*.

2. *Claim 11*

See §VII.H.2; EX1003, ¶¶246-57.

J. Ground 6: Claims 1, 3, 5-9, 12, 13, and 17-20 are anticipated and/or rendered obvious by *Sakai*

1. *Claim 1*

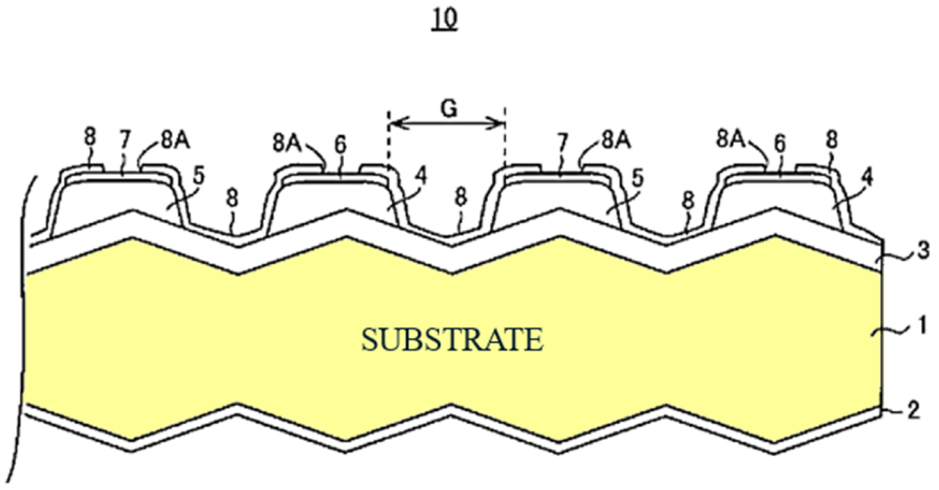
a) Claim 1[p]

Sakai discloses various embodiments of "photoelectric conversion elements," *i.e.*, solar cells. EX1009, [0006], [0008]-[0009], Figs. 1A-1B (element 10); *see also id.,* [0172] ("heterojunction solar cell"), [0038] ("photoelectric conversion element, a solar cell module provided therewith..."), Figs. 2-21; EX1003, ¶¶258-60.

b) Claim 1[a]

Sakai's photoelectric conversion elements include a "semiconductor substrate" 1 that is, *e.g.*, "an n-type single crystal silicon substrate." EX1009, [0025]-[0026], [0028], Fig. 1A; EX1003, ¶261.

[FIG. 1B]

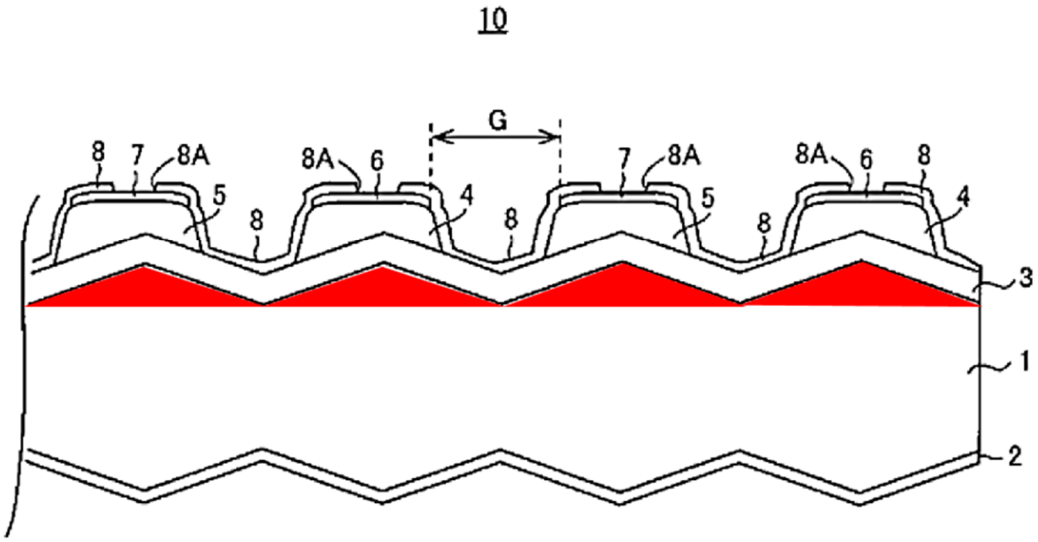


EX1009, Figure 1B (annotated).

c) Claim 1[b]

Sakai refers to the surface of substrate 1 with layers 4 and 5 as the substrate's "back surface". EX1009, [0027]. *Sakai* states that substrate 1 has texture structures or "unevenness" on both surfaces (including the back surface) that include multiple substructures across the surface. *Id.*, [0028], [0045] (texture has "unevenness of various sizes and shapes formed in plurality"). Figure 1B shows such texture substructures on the back surface.

[FIG. 1B]



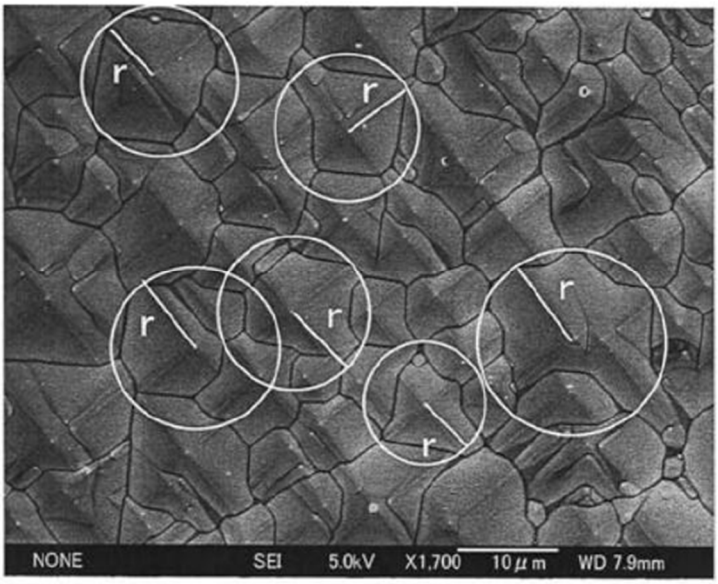
EX1009, FIG. 1B (annotated).

Sakai discloses that the textured substructures may be "quadrangle pyramid-shaped or ***truncated*** quadrangular pyramid-shaped," the latter of which is a frustum

or non-pyramid-shaped microstructure having planar top surface in the shape of a polygon with at least four sides. *Id.*, [0045]. Thus, a POSITA would understand Sakai to disclose non-pyramid-shaped texture structures on the back surface of the substrate. EX1003, ¶¶262-63. *Sakai* also states the "unevenness includes overlapping portions and deformed portions," EX1009, [0045], disclosing that at least some of the non-pyramid substructures may be at least partially stacked on one another. *Id.* None of these disclosures appear in the portions of *Sakai* translated to English in the '136 Patent's prosecution history.

Sakai states that the size of the texture substructures on the back surface is less than 15 μm. EX1009, [0028], [0120], [0135]. For example, *Sakai* explains that, when the textured surface is viewed in a top-down view (see Fig. 2 below), "an average value of a diameter of a circumscribed circle of a convex portion of the texture structure is less than 15 μm." *Id.*, [0021], [0046]-[0047]; *see also id.*, [0121] ("the size of the texture may be controlled by changing various conditions ….").

[FIG. 2]



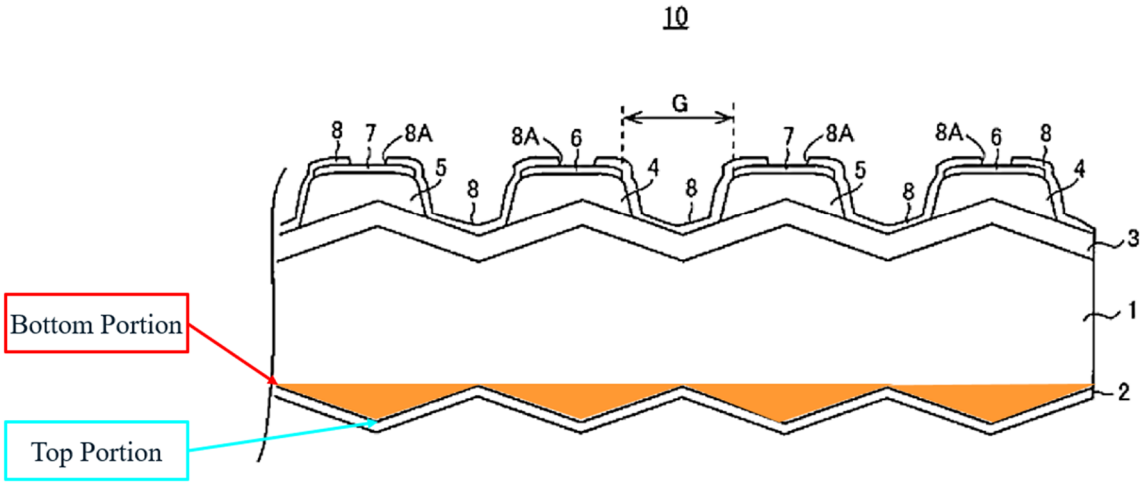
Therefore, *Sakai* discloses and renders obvious that the top surface of truncated quadrangle pyramid-shaped substructures have a one-dimensional size of less than 45 μm. EX1003, ¶264.

d) Claim 1[c]

Sakai refers to the surface of substrate 1 on which film 2 is formed as the "light-receiving surface," which is opposite the "back surface." EX1009, [0027]. *Sakai* states substrate 1 has texture structures or "unevenness" on both surfaces that include multiple substructures across the surface. *Id.,* [0028], [0045]. *Sakai* discloses that the textured structure may be "quadrangular pyramid-shaped." *Id.*, [0045]; *see also id.*, Figs. 1B & 2 (depicting pyramid structures). The front surface pyramid-shaped microstructure includes a top portion away from the substrate and a bottom

portion close to the substrate.

[FIG. 1B]



EX1009, FIG. 1B (annotated); EX1003, ¶265. *Sakai* notes the "pyramid-shaped uneven structure" or "fine pyramid-shaped" texture structure on the substrate's front surface has a "height from the bottom surface of a concave portion to the top of a convex portion." EX1009, [0117]-[0120]. Thus, POSITAs would have understood *Sakai* to disclose pyramid-shaped texture structures on the front surface of the substrate. EX1003, ¶¶265-66.

e) Claim 1[d]

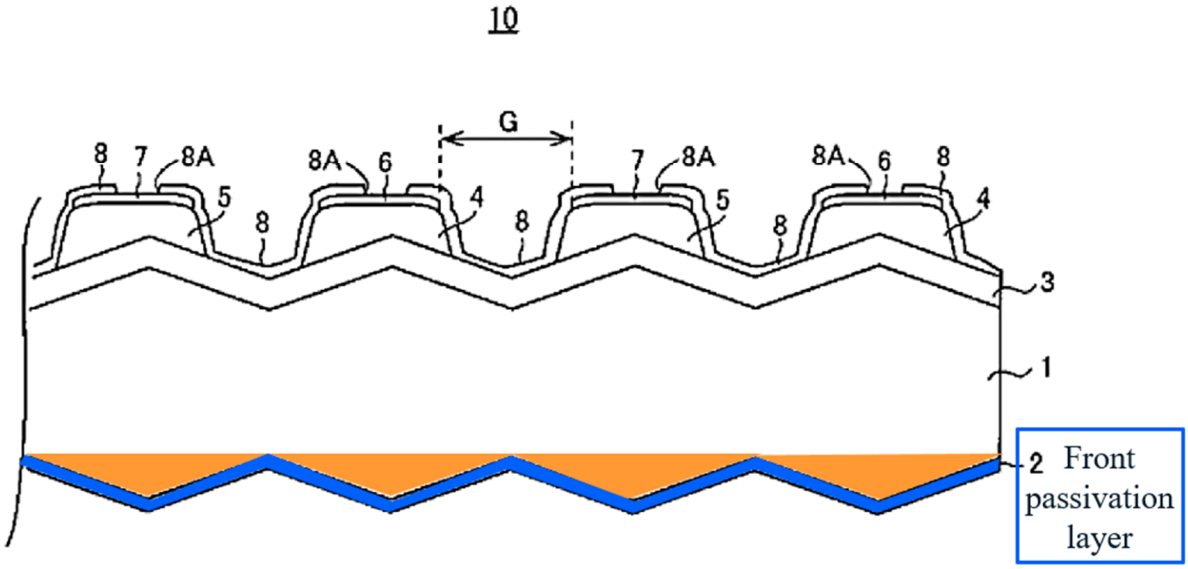
Sakai discloses that the "fine pyramid-shaped" texture structure on the substrate's front surface has a "height from the bottom surface of a concave portion to the top of the convex portion [that] is 1 μm or less," which is less than 5 μm. EX1009, [0120]; EX1003, ¶267; *see also id.* (calculating pyramid height). None of

these disclosures appear in the portions of *Sakai* translated to English in the '136 Patent's prosecution history.

f) Claim 1[e]

Sakai describes antireflective film 2 on the textured light-receiving surface of substrate 1 composed of a silicon nitride film and optionally an oxide film. EX1009, [0029], [0122]-[0124] (discussing formation of silicon nitride film 12 and oxide film 11, collectively labeled film 2 in Figures 7-10).

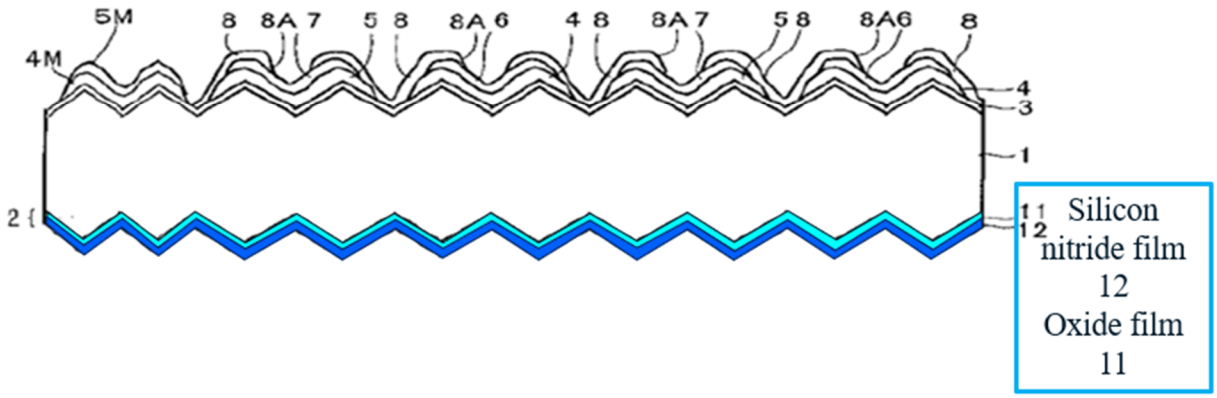
[FIG. 1B]



EX1009, FIG. 1B (annotated).

[FIG. 10]

(m)



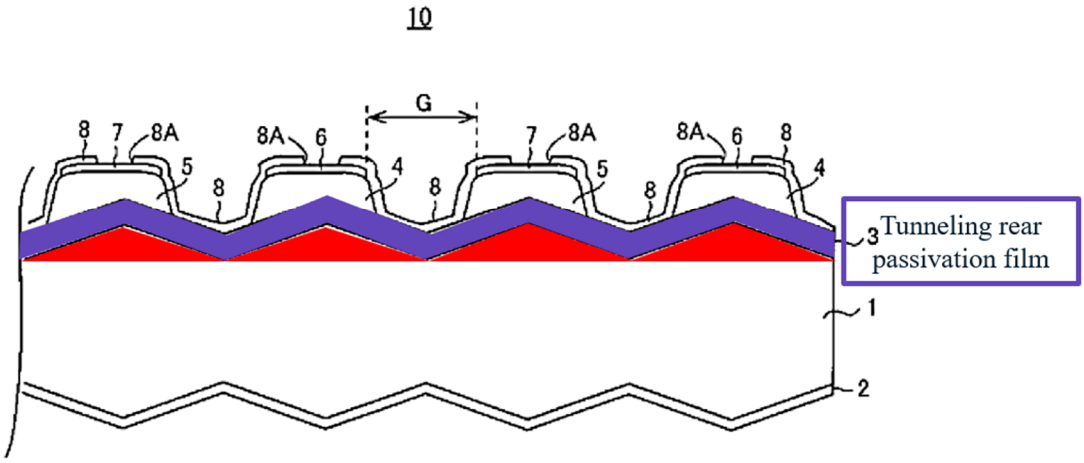
EX1009, FIG. 10 (annotated). POSITAs would understand that antireflective film 2 is a passivation layer. EX1003, ¶¶64, 268.

Alternatively, *Sakai* discloses optional embodiments in which "an intrinsic amorphous semiconductor layer or an n-type or p-type conductive amorphous semiconductor layer may be inserted between the antireflective layer 2 and the light-receiving surface" of the substrate, and that "[i]n this case, the passivation property of the light-receiving surface may be improved, which is preferable." EX1009, [0039]. As discussed in §VII.A.2.f), this embodiment is consistent with Patent Owner's application of the claims to Petitioners' accused products in the district court. Regardless, *Sakai* discloses embodiments with and without an emitter layer between the front substrate surface and the passivation layer, and thus discloses claim 1[e] under any plausible construction. EX1003, ¶269.

g) Claim 1[f]

Sakai describes film 3 on the substrate's textured back surface composed of "any of amorphous silicon, an oxide of amorphous silicon, a nitride of amorphous silicon, an oxynitride of amorphous silicon, and polycrystalline silicon." EX1009, [0040]; *see also id.*, [0260] (film 301 composed of "i-type amorphous silicon"); EX1003, ¶270.

[FIG. 1B]



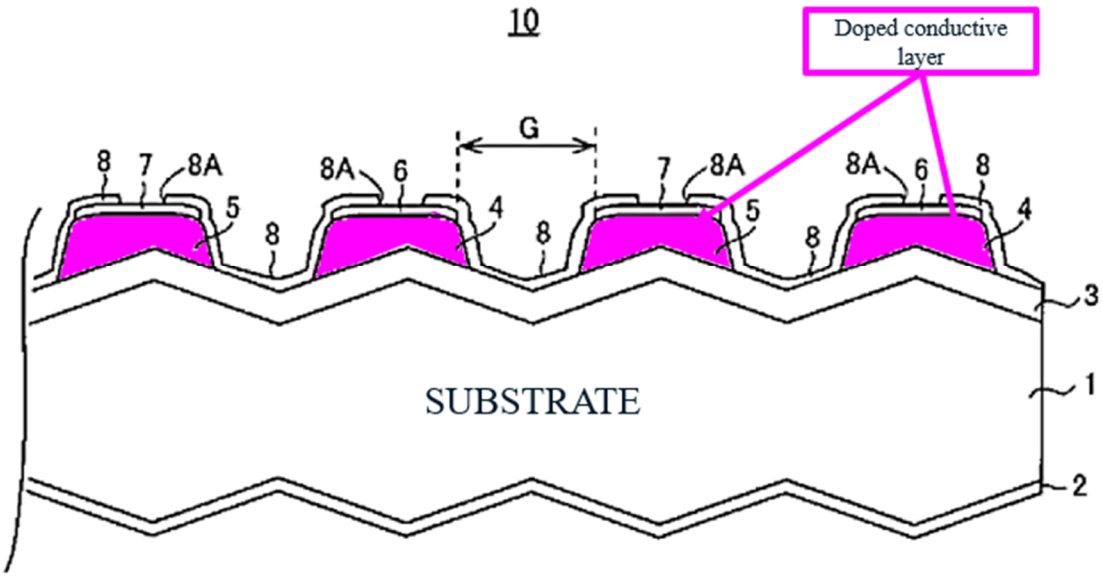
EX1009, FIG. 1B (annotated). *Sakai* states when film 3 "is composed of a silicon insulating film, [it] has a film thickness that allows carriers (electrons and holes) to tunnel." *Id.*, [0042] (ranges of 1-20 nm, or 3-8 nm); *see also id.*, [0159]. Therefore, POSITAs would understand film 3 is a tunnel oxide layer. EX1003, ¶271.

h) Claim 1[g]

Sakai describes n-type amorphous semiconductor layer 4 deposited in contact with film 3 that includes phosphorus as an n-type dopant. EX1009, [0031], [0043].

Sakai also describes that p-type amorphous semiconductor layer 5 is deposited in contact with n-type amorphous semiconductor layer 4 that includes boron as a p-type dopant. *Id.*, [0032], [0044].

[FIG. 1B]



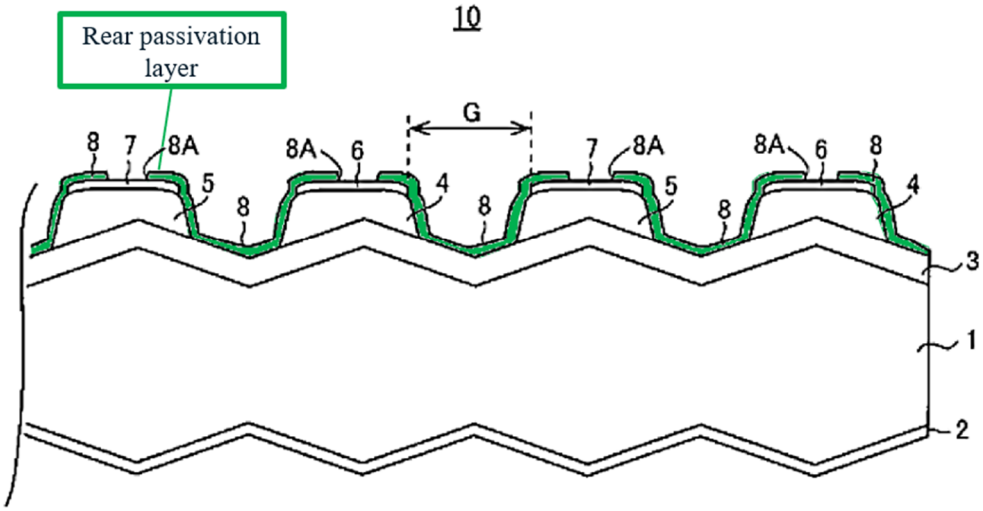
EX1009, FIG. 1B (annotated). POSITAs would have understood that either of layers 4 or 5 or the combination thereof is a "doped conductive layer." EX1003, ¶272.

i) Claim 1[h]

Sakai describes protective dielectric film 8 deposited on the n-type and p-type amorphous semiconductor layers that includes "an inorganic insulating material" such as "an oxide film, a nitride film, an oxynitride film, or the like." EX1009, [0038], [0065]-[0068], [0073]. Film 8 may be a single layer or multiple sublayers

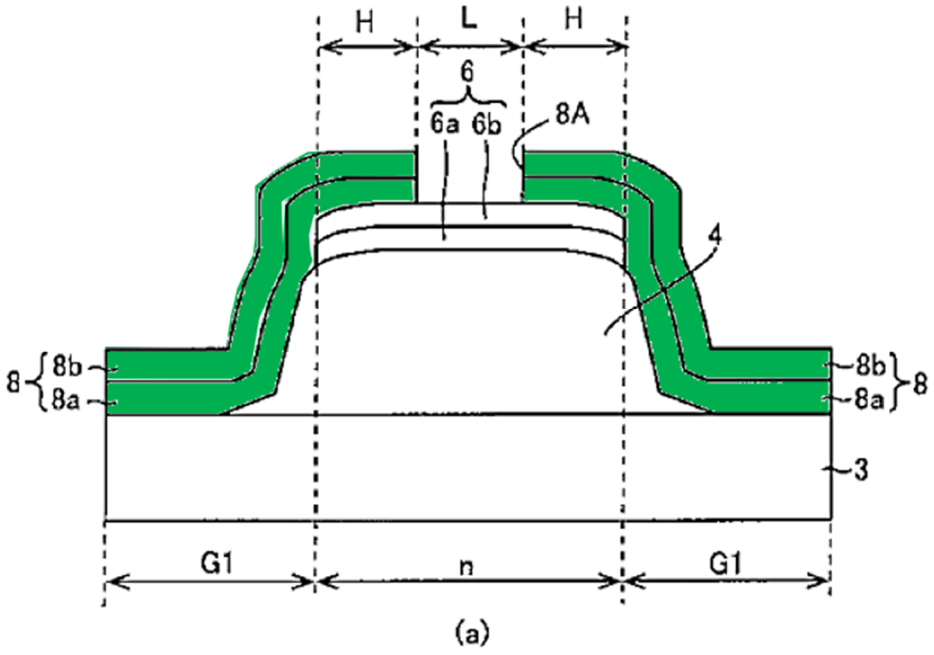
(*e.g.*, layers 8a and 8b), and its sublayers may include an amorphous semiconductor layer composed of various materials. *Id.*, [0070]-[0072]; EX1003, ¶273.

[FIG. 1B]



EX1009, FIG. 1B (annotated).

[FIG. 3]



EX1009, FIG. 3 (annotated). When protective film 8 is a multi-layer structure that includes an amorphous semiconductor layer (*e.g.*, 8a), "it possible to achieve both passivation of the n-type amorphous semiconductor layer 4 and the p-type amorphous semiconductor layer 5, and insulation between electrodes 6 and 7, which is preferable." *Id.*, [0078]. Therefore, *Sakai* discloses claim 1[h]. EX1003, ¶274.

2. *Claim 3*

As noted for claim 1[b], *Sakai* teaches that the textured structures on the substrate's back surface may be "truncated quadrangular pyramid-shaped," *i.e.*, a frustum or non-pyramid-shaped structure having a planar top surface with four sides. EX1009, [0045]. POSITAs would understand that the top surface of each such

truncated quadrangular pyramid is in the shape of a square, a trapezoid, a diamond, or substantially one of those shapes. EX1003, ¶275.

3. *Claim 5*

As discussed for claim 1[b], *Sakai* teaches that the back surface of the semiconductor substrate includes textured microstructures that have a truncated quadrangle pyramid shape with a top surface with a one-dimensional size of less than 45 μm. *Sakai* states that the textured microstructures or unevenness on the substrate, including those on the back surface, "includes overlapping portions." EX1009, [0045]. POSITAs would understand that at least some of the truncated pyramid-shaped microstructures include portions that are not overlapped or stacked. EX1003, ¶276.

4. *Claim 6*

See §VII.J.3. As noted for claim 1[b], *Sakai* discloses or teaches that the substrate's back surface includes textured microstructures having a truncated quadrangle pyramid shape with a top surface, *i.e.*, a frustum or non-pyramid-shaped microstructure having planar, polygonal top surface with at least four sides. EX1009, [0045]. POSITAs would understand that this teaching applies to all microstructures of that shape, including those that are not overlapped or stacked. EX1003, ¶277.

5. *Claim 7*

a) Claim 7[a]

See §VII.J.1.g). *Sakai* states that film 3 may be composed of various materials, including an oxide of an amorphous silicon or an oxynitride of an amorphous silicon. EX1009, [0040]; *see id.*, [0042] (film 3 in embodiment 1 is composed of "a thermal oxide film of silicon"). These read on a silicon oxide layer or a silicon oxynitride layer as claimed. EX1003, ¶278.

b) Claim 7[b]

Sakai states that film 3 has a thickness of 1-20 nm (which overlaps the claimed range), and in some embodiments its thickness is 2 nm (which falls within the claimed range). EX1009, [0042]. Therefore, *Sakai* discloses the claimed range,[9] or alternatively presumptively discloses it and renders it obvious.[10] EX1003, ¶279. Moreover, silicon oxide layers having thicknesses within the claimed portion of that range were well known as appropriate tunneling layers and would have been obvious for POSITAs to select. EX1003, ¶¶65, 280; *see also* §VII.D.1 (Ground 3).

6. *Claim 8*

a) Claim 8[a]

See §VII.J.1.i). *Sakai* states that protective dielectric film 8 may be composed of "an oxide film, a nitride film, an oxynitride film, or the like" (EX1009, [0038],

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9 *Titanium Metals Corp. v. Banner*, 778 F.2d 775, 781-82 (Fed. Cir. 1985).

10 *ClearValue*, 668 F.3d at 1345; *UCB*, 65 F.4th at 689-90.

[0065]-[0068], [0073]), and that its sublayers may be composed of amorphous silicon nitride, amorphous silicon oxide, amorphous silicon oxynitride, amorphous silicon carbon oxide, or the like. *Id.*, [0070]-[0072]. These read on a silicon nitride layer, a silicon oxide layer, or a silicon oxynitride layer as claimed. EX1003, ¶281.

b) Claim 8[b]

Sakai describes forming protective film 8 by sequentially depositing (i) "an intrinsic amorphous semiconductor film" having a thickness of, *e.g.*, 10 nm, followed by (ii) a silicon nitride film having a thickness of, *e.g.*, 120 nm. EX1009, [0153]. The total thickness of those films would be 130 nm, which presumptively renders obvious the claimed range of 70-120 nm. *See Titanium Metals*, 778 F.2d at 783 ("proportions are so close that [POSITAs] would have expected them to have the same properties"); *see also* EX1003, ¶¶282-83 (POSITAs would adjust thicknesses of component films if appropriate); EX1034, [0134] (thickness of composite films "can be flexibly adjusted"); EX1015, 96-100 (calculation of film thicknesses was routine).

7. *Claim 9*

See §VII.J.1.f). *Sakai* states antireflective film 2 includes a silicon nitride film. EX1009, [0029] [0039]; [0122]-[0124] (discussing formation of silicon nitride film 12, which is part of film 2); EX1003, ¶284.

8. *Claim 12*

a) Claim 12[a]

See §VII.J.1.b). POSITAs would understand that a "single crystal" silicon is a monocrystalline silicon. EX1003, ¶285.

b) Claim 12[b]

See §VII.J.1.h), *i.e.*, n-type amorphous semiconductor layer 4 deposited in contact with film 3 that includes phosphorus as an n-type dopant. EX1009, [0031], [0043]. *Sakai* states layer 4 may be composed of n-type amorphous silicon. *Id.*, [0043]; EX1003, ¶286.

c) Claim 12[c]

See §VII.J.1.h). *Sakai* states that layer 4 may have a film thickness of 5-50 nm. EX1009, [0043], which presumptively renders obvious the claimed range of 60-200 nm. *See Titanium Metals*, 778 F.2d at 783; *see also* EX1003, ¶287. Therefore, it would have been obvious for POSITAs to form *Sakai's* layer 4 to have a thickness of 60-200 nm. EX1003, ¶287.

9. *Claim 13*

See §VII.A.9 and VII.J.1; EX1003, ¶¶288-97.

10.*Claim 17*

See §VII.J.3; EX1003, ¶298.

11.*Claim 18*

See §VII.J.4; EX1003, ¶299.

12.*Claim 19*

See §VII.J.5; EX1003, ¶¶300-01.

13.*Claim 20*

See §VII.J.6; EX1003, ¶¶302-03.

K. Ground 6A: Claims 1-3, 5-9, 12-15, and 17-20 are rendered obvious by *Sakai* in view of *Yun.*

1. *Rationale to Combine Sakai and Yun*

Sakai relates to the field of solar cells, and more specifically to preparing a cell that reduces photoelectric conversion inefficiencies due to overlapping of n-type and p-type semiconductor layers. EX1009, [0005]. As such, *Sakai* relates to the same field and problem as the '136 Patent, and is therefore analogous art to the '136 Patent.[11] EX1003, ¶¶304-06.

Sakai describes solar cells that have texture surfaces on both the front and rear sides, with at least the front side texture having a pyramid shape. See §VII.J.1.d). *Sakai* describes forming the texture surfaces with "wet etching using an alkaline etching solution" such as a sodium hydroxide solution optionally with an isopropyl alcohol etching inhibitor. EX1009, [0116]. *Sakai* also teaches that the size of texture structures may be controlled by changing conditions of the etching solution, including the type of etching inhibitor. *Id.*, [0120]-[0121]. *Sakai* then describes

[11] The '136 Patent Examiner cited *Sakai* as the closest prior art, confirming *Sakai* is analogous art. EX1018, 15-16.

varying the size of the texture structure on the substrate's back surface to reduce light reflection, thereby facilitating the reliable determination of alignment marks during cell manufacturing. *Id.*, [0160]-[0168]; EX1003, ¶307.

Yun teaches using similar wet chemical methods (*i.e.*, alkaline solution with an isopropanol additive) to create textured structures on the rear side of a double-sided solar cell that include platform-shaped structures of certain sizes. EX1005, [0019], [0043], [0056]. POSITAs would have been motivated to use *Yun's* wet chemical methods to form the textured structures on the rear side of *Sakai's* TOPCon cell to control the size and shape of the textured structures as taught in *Sakai*, *e.g.*, to facilitate recognition of manufacturing alignment marks. EX1003, ¶308. That would form overlapping platform-shaped (non-pyramid) structures of the sizes claimed in the '136 Patent. POSITAs would have had a reasonable expectation of success in the combination because it uses a known method (wet chemical methods) to obtain predictable results (forming non-pyramid textures of different shapes and sizes). *Id*.; EX1005, [0019], [0043], [0056].

2. *Claims 1 & 13*

a) Claim 1[p], 1[a], and 1[c]-[h]; Claim 13[p], 13[a], and 13[c]-[h]

As discussed in Ground 6, *Sakai* discloses those elements. EX1003, ¶¶309-310, 312-17, 330-31, 333-38.

b) Claim 1[b] and 13[b]

To the extent that *Sakai* does not disclose these elements, as discussed in §VII.B.2.c), *Yun* does. EX1003, ¶¶311, 332.

3. *Dependent Claims 5-9, 12, and 17-20*

As discussed in Ground 6, *Sakai* discloses those elements. EX1003, ¶¶320-29, 341-46.

4. *Dependent Claims 2, 3, 5-6, 8, 12, 14-15, 17-18, and 20*

To the extent *Sakai* does not disclose these claims, as discussed in Ground 1A, *Yun* does. EX1003, ¶¶318-21, 324-25, 327-29, 339-42, 345-46.

L. Grounds 7 and 7A: Claim 10 is rendered obvious by *Sakai* in view of *Yu* (and optionally *Yun*)

1. *Rationale to Combine Sakai and Yu (and optionally Yun)*

Sakai discloses TOPCon solar cells having a textured front side that is passivated with a silicon nitride film and optionally an oxide film (see §VII.J.1.f)) but is silent on the specific oxide used and on the thickness of those layers when an oxide film is used. EX1003, ¶¶347-48. Therefore, POSITAs would have found it obvious to make the front side passivation films in *Sakai* or *Yun* of the oxides and thicknesses described in *Yu* for the same reasons discussed in Grounds 4 and 4A. *See id.*; §VII.F.1, §VII.G.1.

2. *Claim 10*

See §VII.F.2; EX1003, ¶¶349-351.

M. Grounds 8 and 8A: Claim 11 is rendered obvious by *Sakai* in view of *Fang* (and optionally *Yun*)

1. *Rationale to Combine Sakai and Fang (and optionally Yun)*

Sakai discloses TOPCon solar cells having a textured front side that is passivated with a silicon nitride film and optionally an oxide film (*see* §VII.J.1.f)) but is silent on the specific oxide used, the thickness of those layers when an oxide film is used, or whether it may include additional passivating layers on the front surface. EX1003, ¶¶352-53. Therefore, POSITAs would have found it obvious to make the front side passivation films in *Sakai* or *Yun* of the sublayers and thicknesses described in *Fang* for the same reasons discussed in Grounds 5 and 5A. *See id.*; §VII.H.1, §VII.I.1.

2. *Claim 11*

See §VII.H.2; EX1003, ¶¶354-57.

VIII. SECONDARY CONSIDERATIONS

Patent Owner has not identified secondary considerations tied to the '136 Patent claims. Petitioners reserve the right to address any such evidence Patent Owner presents. However, if Patent Owner could establish secondary considerations and nexus, they would not overcome the strong obviousness case. *Leapfrog Enters., Inc. v. Fisher-Price, Inc.*, 485 F.3d 1157, 1162 (Fed. Cir. 2007).

Respectfully submitted,

BAKER BOTTS L.L.P.

/Elizabeth Durham Flannery/
Elizabeth Durham Flannery (Reg. No. 59,509)
Lead Attorney for Petitioners

Date: February 18, 2026

BAKER BOTTS L.L.P.
910 Louisiana Street
Houston, TX 77002
Phone: (713) 229-2104
Fax: (713) 229-7704
liz.flannery@bakerbotts.com

CERTIFICATE OF COMPLIANCE WITH TYPE-VOLUME LIMITATION, TYPEFACE REQUIREMENTS, AND TYPE STYLE REQUIREMENTS

1. This Petition complies with the type-volume limitation of 14,000 words, comprising 13,750 words, excluding the parts exempted by 37 C.F.R. § 42.24(a).

2. This Petition complies with the general format requirements of 37 C.F.R. § 42.6(a) and has been prepared using Microsoft® Word in 14-point Times New Roman.

Respectfully submitted,

BAKER BOTTS L.L.P.

/*Elizabeth Durham Flannery*/
Elizabeth Durham Flannery (Reg. No. 59,509)
Lead Attorney for Petitioners

Date: February 18, 2026

CERTIFICATE OF SERVICE

In accordance with 37 C.F.R. §§ 42.6(e) and 42.105, the undersigned certifies that on the February 18, 2026, a complete and entire copy of this Petition for *Inter Partes* Review under 35 U.S.C. § 311 and 37 C.F.R. § 42.104, and all supporting exhibits were provided via Federal Express, postage prepaid, to the Patent Owner and its known representatives by serving the correspondence address of record for the ’136 Patent Owner and the Patent Owner’s counsel:

NIXON PEABODY, LLP, ATTN: EISENSTEIN, RONALD, 799 NINTH STREET, NW, SUITE 500, WASHINGTON, DC 20001, UNITED STATES

The undersigned further certifies that a courtesy copy of the complete and entire Petition, and all supporting exhibits, were provided by electronic service to counsel retained by Patent Owner in the Related Matters identified herein:

FOLEY & LARDNER LLP, 11988 EL CAMINO REAL, SUITE 400, SAN DIEGO, CA 92130

ray.wu@foley.com

mlaurence@foley.com

foleyinternaljinkoseg@foley.com

Date: February 18, 2026

Respectfully submitted,

BAKER BOTTS L.L.P.

/*Elizabeth Durham Flannery*/
Elizabeth Durham Flannery (Reg. No. 59,509)
Lead Attorney for Petitioners