

BOE Tech. Group. Co., Ltd.

V.

Optronic Sciences LLC

IPR2024-01132

Pat. 7,586,121

Patent Owner's Demonstrative Exhibits

■ Demonstrative Exhibit — Not Evidence

1



Technology Background

 Demonstrative Exhibit — Not Evidence

2

Background: Patent 7,586,121



US007586121B2

(12) **United States Patent**
Sun

(10) **Patent No.:** **US 7,586,121 B2**
(45) **Date of Patent:** **Sep. 8, 2009**

(54) **ELECTROLUMINESCENCE DEVICE HAVING STACKED CAPACITORS**

(75) Inventor: **Wein-Town Sun, Hsinchu (TW)**

(73) Assignee: **Au Optronics Corp., Hsinchu (TW)**

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 414 days.

(21) Appl. No.: **11/005,648**

(22) Filed: **Dec. 7, 2004**

(65) **Prior Publication Data**
US 2006/0121310 A1 Jun. 8, 2006

(51) Int. Cl. **H01L 29/04** (2006.01)
H01L 31/036 (2006.01)

(52) U.S. Cl. **257/59; 257/72; 257/296; 257/350; 349/43; 349/111**

(58) **Field of Classification Search** **257/40; 257/72; 79; 296; 303; 306; 59; 350; 349/43; 349/111**

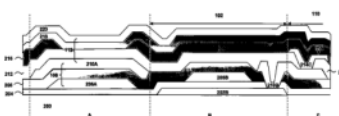
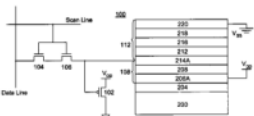
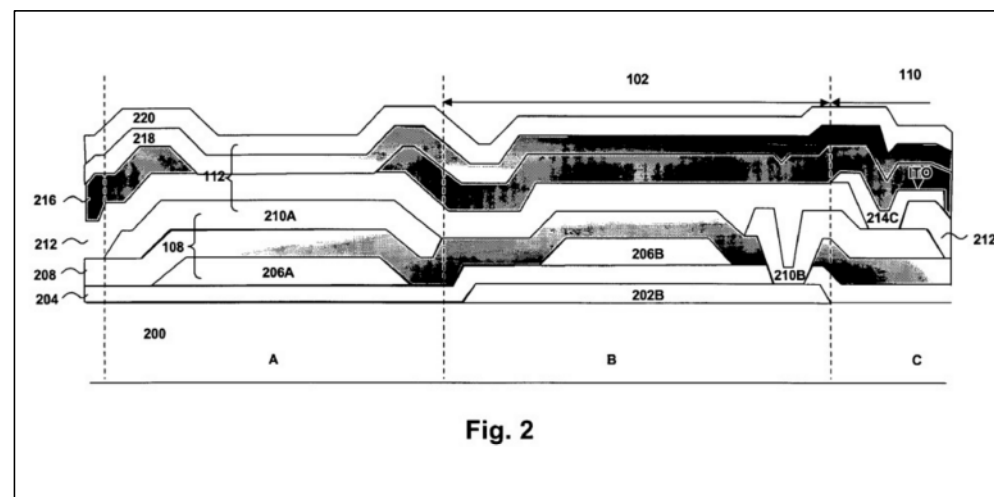
See application file for complete search history.

(56) **References Cited**
U.S. PATENT DOCUMENTS
6,610,997 B2 * 8/2003 Murada 257/72
2002/0104995 A1 * 8/2002 Yamazaki et al. 257/72
* cited by examiner

(74) **Attorney, Agent, or Firm**—Thomas, Kayden, Horstseyer & Risley

(57) **ABSTRACT**
An electroluminescence (EL) device includes a substrate and a plurality of pixels formed on the substrate. Each pixel includes a first area including at least a first capacitor and a second capacitor, the first capacitor including a first conductive layer, a first dielectric layer over the first conductive layer, and a second conductive layer over the first dielectric layer, and the second capacitor including the second conductive layer, a second dielectric layer over the second conductive layer, and a third conductive layer over the second dielectric layer, and a second area including a first semiconductor layer formed on the substrate, a first gate oxide layer over the first semiconductor layer, and a fourth conductive layer over the first gate oxide layer.

7 Claims, 8 Drawing Sheets

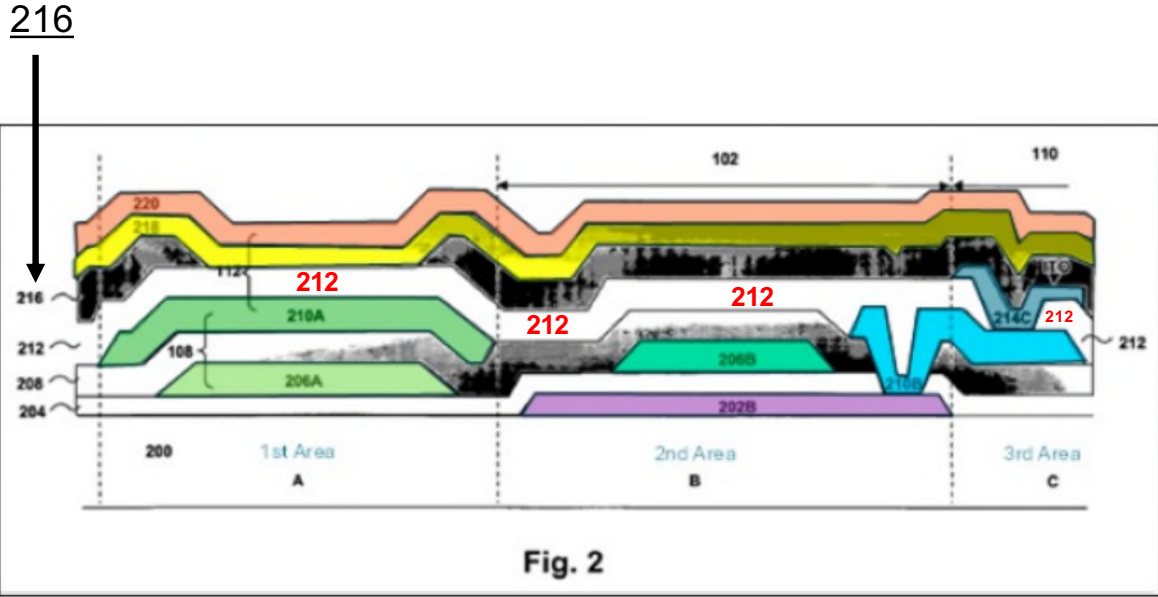




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Ex. 1001 (Sun Patent)

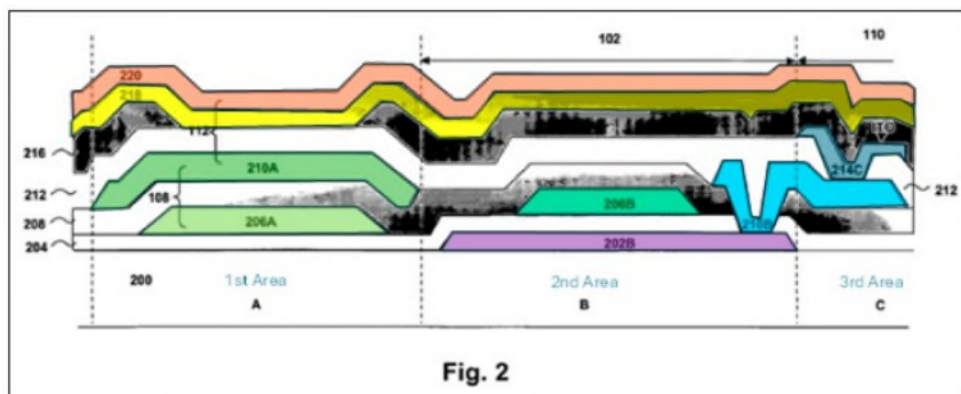
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Background: Patent 7,586,121



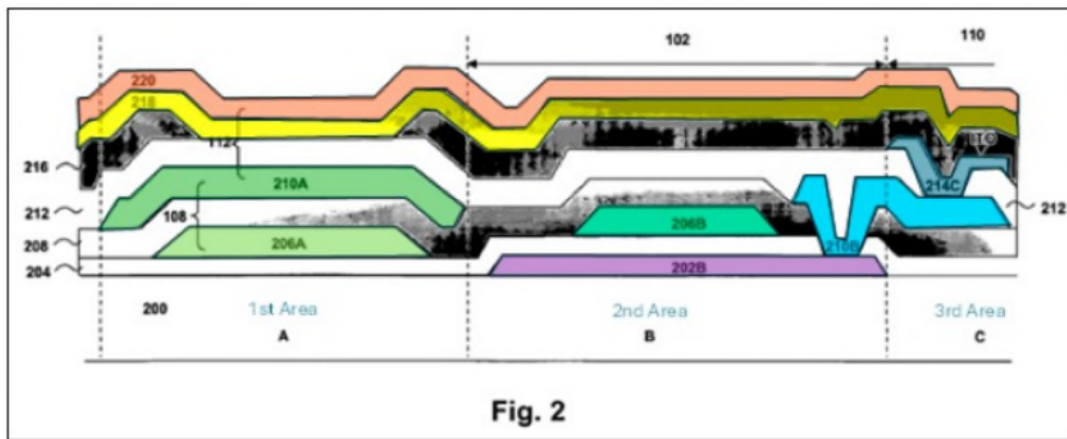
A layer of *passivation silicon nitride (SiN) 212* is formed over ILD 208 and second metal patterns 210A and 210B. A layer of indium tin oxide (ITO) is formed over passivation SiN 212 and patterned to form an ITO pattern 214C over area C of substrate 200, wherein ITO pattern 214C contacts second metal pattern 210B through a via hole (not numbered) in passivation SiN 212. A layer of capping SiN 216 is deposited to cover passivation SiN 212 and ITO pattern 214C. A layer of organics 218 [yellow] is deposited over all of areas A, B, and C. Over area A, capping SiN 216 is also patterned to expose a portion of passivation SiN 212.

Background: Patent 7,586,121



1. An electroluminescence (EL) device, comprising:
 - a substrate; and
 - a plurality of pixels formed on the substrate, each pixel being in a respective pixel area, each pixel area including at least a first area, a second area, and a third area, wherein each pixel includes:
 - at least a first capacitor and a second capacitor in the first area, the first capacitor including a first conductive layer formed over a first gate oxide layer, a first dielectric layer over the first conductive layer, and a second conductive layer over the first dielectric layer, and the second capacitor including the second conductive layer, a second dielectric layer over the second conductive layer, and a third conductive layer over the second dielectric layer;
 - a transistor in the second area, the transistor including a first semiconductor layer formed on the substrate, the first gate oxide layer over the first semiconductor layer, and a fourth conductive layer over the first gate oxide layer, wherein the fourth conductive layer is formed of the same conductive film as the first conductive layer, and wherein both the first conductive layer and the fourth conductive layer are directly formed on the gate oxide layer; and
 - a light emitting device in the third area, the light emitting device including a fifth conductive layer, a first organic layer over the fifth conductive layer, and a sixth conductive layer over the first organic layer, wherein the sixth conductive layer is formed of the same conductive film as the third conductive layer.

Background: Patent 7,586,121



3. The device of claim 1, wherein the second dielectric layer comprises a passivation layer and a capping layer.

4. The device of claim 3, wherein at least one of the passivation layer and the capping layer comprises silicon nitride.

Claim Construction

“[O]nly those terms need be construed that are in controversy, and only to the extent necessary to resolve the controversy.”

Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc., 200 F.3d 795, 803 (Fed. Cir. 1999).

Petition Rests Entirely on Flawed Constructions

- The Petition’s theories *only* stand if the Board finds that “passivation” carries no special meaning other than it is an insulation material
- Petition’s overbroad construction should be rejected—all its theories fail

Id., 5:40-42. A POSITA would understand from the 121 patent that there is no special meaning ascribed to passivation layer and capping layer other than they are two separate layers of insulation material. EX1002, ¶61. Moreover, given that the

Id., 5:40-42. A POSITA would understand from the 121 patent that there is no special meaning ascribed to passivation layer and capping layer other than they are two separate layers of insulation material. EX1002, ¶70. Moreover, given that the

Id., 5:40-42. A POSITA would understand from the 121 patent that there is no special meaning ascribed to passivation layer and capping layer other than they are two separate layers of insulation material. EX1002, ¶111. Moreover, given that

patterns 210A and 210B.” EX1001, 5:34-36. A POSITA would understand from the 121 patent that there is no special meaning ascribed to passivation layer other than it is a layer of insulation material. EX1002, ¶134.

“Passivation”: Intrinsic Evidence

3. The device of claim 1, wherein the second dielectric layer comprises a passivation layer and a capping layer.

Dielectric ≠ Passivation ≠ Capping

The terms should not all be construed as nothing more than “*insulation material*.”

“It is highly disfavored to construe terms in a way that renders them void, meaningless, or superfluous.”

Intel Corp. v. Qualcomm Inc., 21 F.4th 801, 810 (Fed. Cir. 2021)

“Passivation”: Extrinsic Evidence

5.2.2 Passivation

passivation The protection of junctions, regions, layers, or surfaces of semiconductors by depositing a material which renders them chemically passive or unreactive. Used, for instance, to protect from oxidation, contamination, and other perils of harsh environments. Two common techniques are glassivation and oxide passivation.

Ex. 2010 at 556

passivation [ELECTR] Growth of an oxide layer on the surface of a semiconductor to provide electrical stability by isolating the transistor surface from electrical and chemical conditions in the environment; this reduces reverse-current leakage, increases breakdown voltage, and raises power dissipation rating. [MET] To render passive; to reduce the reactivity of a chemically active metal surface by electrochemical polarization or by immersion in a passivating solution. { ,pas·ə'vā·shən }

Ex. 2012 at 1455

Passivation is often defined as a process whereby a film is grown on the surface of a semiconductor to either (a) chemically protect it from the environment, or (b) provide electronic stabilization of the surface.

From the earliest days of solid state electronics it has been recognized that the presence or absence of surface states plays a decisive role in the usefulness of any semiconducting material. On the surface of any solid state material there are sites in which the coordination environment of the atoms is incomplete. These sites, commonly termed “dangling bonds”, are the cause of the electronically active states which allow for the recombination of holes and electrons. This recombination occurs at energies below the bulk value and interferes with the inherent properties of the semiconductor. In order to optimize the properties of a semiconductor device it is desirable to covalently satisfy all these surface bonds, thereby shifting the surface states out of the band gap and into the valence or conduction bands. Electronic passivation may therefore be described as a process which reduces the density of available electronic states present at the surface of a semiconductor, thereby limiting hole and electron recombination possibilities. Both Si and GaAs require passivation. In the case of silicon both the native oxide (Sect. 5.4.1) and other oxides (Sects. 5.4.2 and 5.4.3) admirably fulfill these requirements. However, GaAs does not grow a suitable oxide [8], and typically employed dielectrics have failed to provide adequate passivation. There has thus been substantial effort targeted at chemical passivation of the surface of GaAs, in particular by gallium sulfides (Sect. 5.6.1).

Chemical passivation requires a material that inhibits the diffusion of oxygen, water, or other species to the surface of the underlying semiconductor. In addition, the material is ideally hard and resistant to chemical attack. In this regard silicon nitride, Si_3N_4 (Sect. 5.5.1), is one of the most widely used materials, and finds applications in both Si and GaAs devices, e.g., Figure 5-1b. A perfect passivation material would satisfy both electronic and chemical passivation requirements, however, while oxide coatings

Ex. 2011 at 265

“Passivation”: Petitioner’s Extrinsic Evidence

Petitioner’s own evidence (not introduced until its reply) completely undercuts the Petition’s invalidity theory

Passivation (1) The application of an insulating layer of glass, SiO₂, or nitride over circuits and circuit elements for protection against moisture, contaminants, or other harmful conditions. (2) The growth of an oxide or nitride layer on the surface of a semiconductor to provide electrical stability by isolating the surface from electrical and chemical conditions in the environment. See also *Glassivation*.

Ex. 1012 at 140

of an oxide layer on the surface of a semiconductor to provide mechanical protection by isolating the transistor surface from electrical, mechanical (scratching of metal), and chemical conditions in the environment. 5. The technique of providing a semiconductor device chip with an isolating layer or “skin” that protects it from contamination by unwanted impurity atoms or molecules. With silicon devices, the isolating layer is usually composed of silicon dioxide (quartz) or silicon nitride, grown on the chip at a high temperature. 6. Electrolytical treatment of a metal or semiconductor to create a chemically bonded oxide layer on the surface to protect it from corrosion. 7. The formation of an insulating layer directly over a circuit or circuit element to protect the surface from contaminants, moisture, or particles. 8. Surface oxidation that

Ex. 1013 at 542

passivation The process or processes (physical or chemical) by means of which a metal becomes passive. (IA) [59]

passivator An inhibitor that changes the potential of a metal appreciably to a more cathodic or noble value. (IA) [59]

Ex. 1014 at 798.

■ Demonstrative Exhibit — Not Evidence

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Petition Asserted Passivation = Insulation

- The Petition's theories *only* stand if the Board finds that “passivation” carries no special meaning other than it is an insulation material
- Petition's construction should be rejected—all theories based on “passivation” fail

Id., 5:40-42. A POSITA would understand from the 121 patent that there is no special meaning ascribed to passivation layer and capping layer other than they are two separate layers of insulation material. EX1002, ¶61. Moreover, given that the

“Capping”: Intrinsic Evidence

3. The device of claim 1, wherein the second dielectric layer comprises a passivation layer and a capping layer.

Dielectric ≠ Passivation ≠ Capping

The terms should not all be construed as nothing more than “*insulation material*.”

“It is highly disfavored to construe terms in a way that renders them void, meaningless, or superfluous.”

Intel Corp. v. Qualcomm Inc., 21 F.4th 801, 810 (Fed. Cir. 2021)



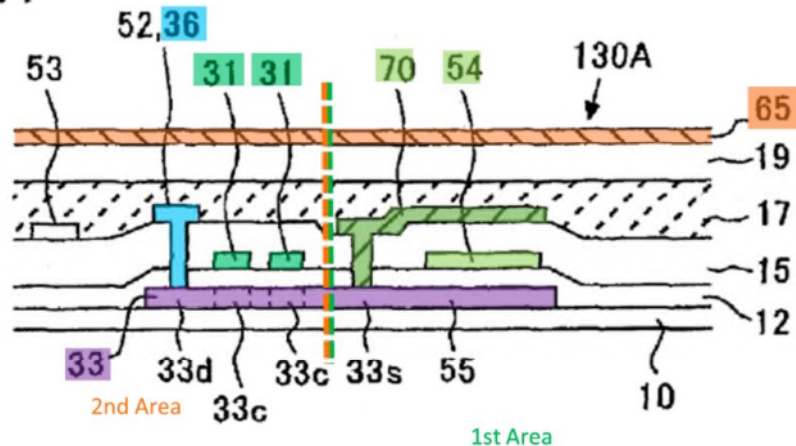
Ground 1: Anzai § 102 (Claims 1–3 and 5)

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Anzai Overview

FIG.2A



No material is disclosed for planarization layer 19

Planarization layer 17 is made of an organic resin

A SiO₂ film, a SiN film and a SiO₂ film are sequentially deposited to form the interlayer insulating film 15 on the entire surface of the gate insulating film 12 and the active layer 33. A drain electrode 36, which is formed by filling a contact hole formed at the location corresponding to the drain 33d with a metal such as Al, is disposed, and a first planarization film 17 made of an organic resin for flattening the surface is formed on the entire surface.

Admitted § 102 Defect: No Passivation and Capping Layer (Claim 3)

- No anticipation of claim 3's "passivation layer and capping layer" under § 102 because the materials are not known, beyond their alleged insulating property:

Anzai discloses that planarization layer 17 may be made of an organic resin for flattening the surface. EX1003, 4:20-24. While Anzai does not disclose the material for planarization layer 19, it must be made of an insulation material

Petitioner's Own Evidence: Not Merely Insulation

- Petitioner's own dictionary definitions show passivation means **more** than mere "insulation"

Passivation (1) The application of an insulating layer of glass, SiO₂, or nitride over circuits and circuit elements for protection against moisture, contaminants, or other harmful conditions. (2) The growth of an oxide or nitride layer on the surface of a semiconductor to provide electrical stability by isolating the surface from electrical and chemical conditions in the environment. *See also Glass-ivation.*

of an oxide layer on the surface of a semiconductor to provide mechanical protection by isolating the transistor surface from electrical, mechanical (scratching of metal), and chemical conditions in the environment. 5. The technique of providing a semiconductor device chip with an isolating layer or "skin" that protects it from contamination by unwanted impurity atoms or molecules. With silicon devices, the isolating layer is usually composed of silicon dioxide (quartz) or silicon nitride, grown on the chip at a high temperature. 6. Electrolytical treatment of a metal or semiconductor to create a chemically bonded oxide layer on the surface to protect it from corrosion. 7. The formation of an insulating layer directly over a circuit or circuit element to protect the surface from contaminants, moisture, or particles. 8. Surface oxidation that

passivation The process or processes (physical or chemical) by means of which a metal becomes passive. (IA) [59]

passivator An inhibitor that changes the potential of a metal appreciably to a more cathodic or noble value. (IA) [59]

No Evidence that Anzai's Organic Resin Passivates

Organic Material ≠ Organic Resin

13 THE WITNESS: I'm unaware of an organic resin
14 used as a planarization film that would serve as a
15 passivation layer. Dr. Neikirk did not give any specific

Ex. 1015 (Bretschneider) at 54:13–16

20 Q So, here, they're saying the -- an organic
21 dielectric layer can serve as a passivation layer; right?

22 MR. CUMMINGS: Objection. Form.

23 THE WITNESS: I have to point out, the language
24 here is organic dielectric, not organic resin. And,

Ex. 1015 (Bretschneider) at 57:20–58:9

18 Q But it's your opinion that no matter what organic
19 material Anzai selects for that planarization layer, the
20 material cannot serve as a passivation layer?

21 MR. CUMMINGS: Objection. Form.

22 THE WITNESS: It's my opinion that the teachings
23 of Anzai and the understanding and opinions expressed by
24 doc -- by Dr. Neikirk say those materials are not -- you
25 can't call them passivation layers.

2 Q No matter what organic material is selected; is
3 that right?

4 MR. CUMMINGS: Objection. Form.

5 THE WITNESS: You're saying no matter what
6 organic material, but Anzai talks about using organic
7 resins, which is a much smaller range of selection of
8 materials.

Ex. 1015 (Bretschneider) at 52:18–53:8

Anzai: No Capping Layer (Claim 3)

- No disclosure that planarization layer 19 is a hard layer to protect layers underneath (a capping layer)
- Anzai does not anticipate claim 3

Anzai discloses that planarization layer 17 may be made of an organic resin for flattening the surface. EX1003, 4:20-24. While Anzai does not disclose the material for planarization layer 19, it must be made of an insulation material

Pet. at 20



Ground 2: Anzai / Yamazaki § 103 (Claim 4)

 Demonstrative Exhibit — Not Evidence

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Yamazaki Overview

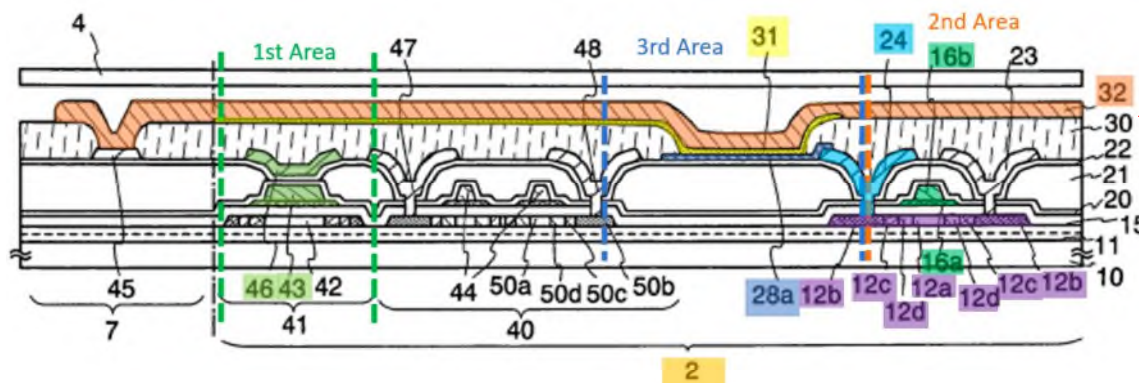


Fig. 2

The insulating material **30** may be a photosensitive or non-photosensitive organic material (such as polyimide, acrylate, polyamide, polyimide amide, resist, or benzocyclobutene), an inorganic material (such as silicon oxide, silicon nitride, or silicon oxynitride) with a CVD method, a sputtering method, or coating method, or a laminate thereof. In the case of using the photosensitive organic material as the insulating material **30**, useful photosensitive organic materials may be roughly grouped into two types. That is, the one is a negative type which becomes insoluble to an etchant by photosensitive light irradiation and the other is a positive type which becomes soluble to the etchant by light irradiation. According to the present invention, both types can be appropriately used.

Ground 2: Claim 4 Depends From Claim 3

Anzai does not anticipate claim 3

Claim 4 is valid due to its dependence from claim 3 and its additional distinguishing features.

4. ***The device of claim 3***, wherein at least one of the passivation layer and the capping layer comprises silicon nitride.

Ex. 1001, Claim 4

Ground 2: No Motivation to Combine

1) Silicon Nitride (SiN) is ***less suitable*** than organic resin for Anzai's ***planarization*** layers

13 Q Why wouldn't you use silicon nitride for
14 planarization layer 17?

15 MR. CUMMINGS: Objection. Form.

16 THE WITNESS: There's no reason to change. Anzai
17 teaches that an organic resin is suitable. The literal
18 way -- there's a few different ways, depending on the size
19 of the display, what you're putting planarization on, that
20 you could do it.

21 On a silicon wafer, it's a -- basically, around
22 substrate. So you drop some on and spin it. It's
23 literally spin coating. It's that simple.

24 For displays which have a rectangular format,
25 there are a few different options for doing it. You could

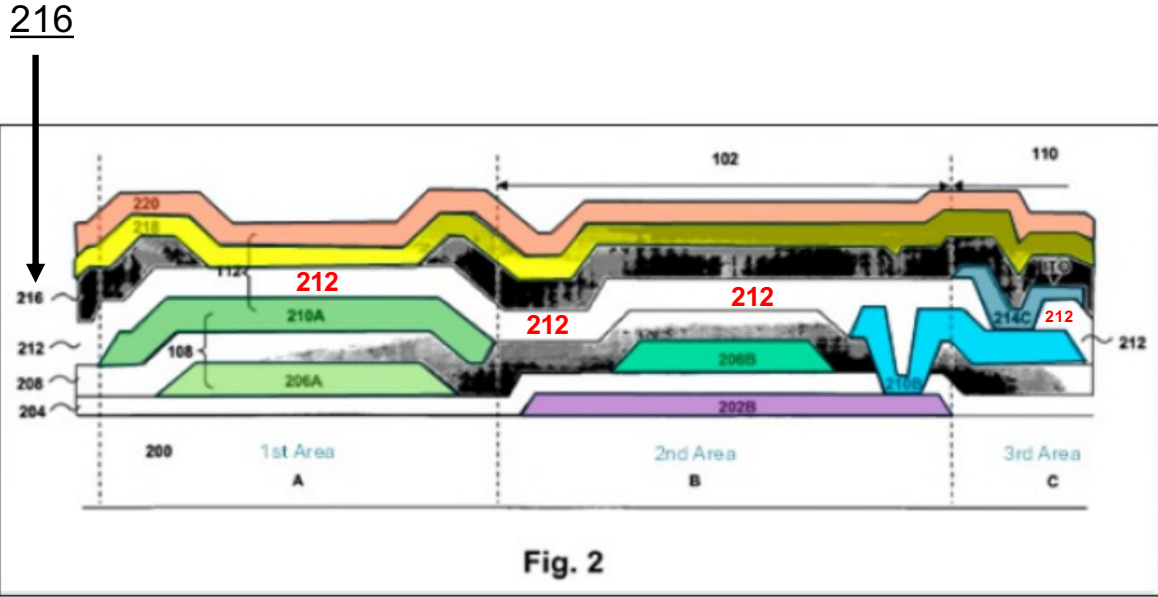
1 still spin it, but there's a -- kind of a squeegee
2 operation that you could do as well to spread it and get
3 the film uniform.

4 It's simple and easy and depositing -- attempting
5 to deposit a uniform flat film of silicon nitride would be
6 more than difficult over a large area because you have to
7 do a separate process for it to function for
8 planarization.

9 So Anzai teaches a simple spin it on versus let
10 me go into a vacuum chamber, deposit silicon nitride, let
11 me do a chemical-mechanical polish, double-check, and then
12 say, "Why would I change that process?" I have no
13 motivation to do it unless I want to spend money and have
14 a lower yield in the process.

Ex. 1015 (Bretschneider Depo) at 69:13–70:14

Background: Patent 7,586,121



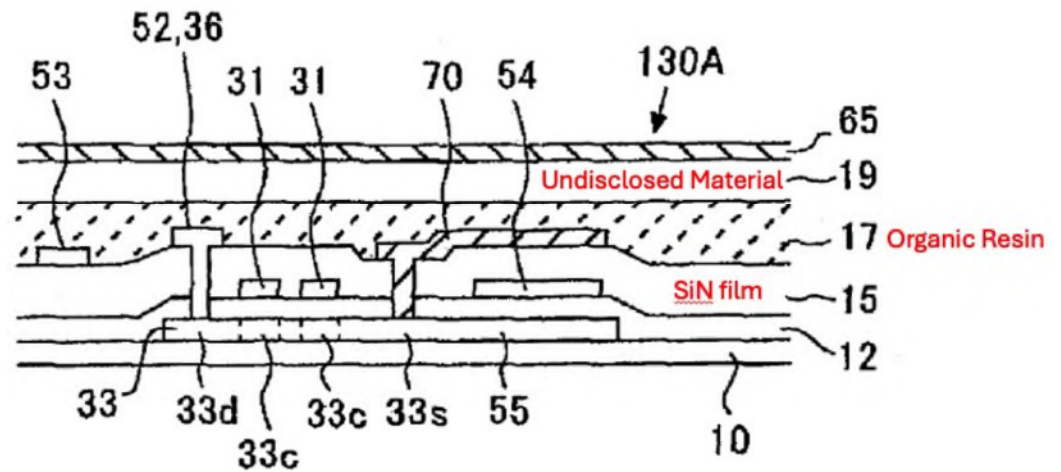
A layer of *passivation silicon nitride (SiN) 212* is formed over ILD 208 and second metal patterns 210A and 210B. A layer of indium tin oxide (ITO) is formed over passivation SiN 212 and patterned to form an ITO pattern 214C over area C of substrate 200, wherein ITO pattern 214C contacts second metal pattern 210B through a via hole (not numbered) in passivation SiN 212. A layer of capping SiN 216 is deposited to cover passivation SiN 212 and ITO pattern 214C. A layer of organics 218 [yellow] is deposited over all of areas A, B, and C. Over area A, capping SiN 216 is also patterned to expose a portion of passivation SiN 212.

Ground 2: No Motivation to Combine

1) Silicon Nitride (SiN) is **less suitable** than organic resin for Anzai's planarization layers

Petitioner's Reply at 16:
"[T]here are competing factors
when choosing materials."

Anzai uses SiN elsewhere in its structure
but **chose not to use it for its
planarization layers**—organic resin is a
more suitable planarization material



POR at 13–14 (annotating Ex. 1003 (Anzai), Fig. 2A)

■ Demonstrative Exhibit — Not Evidence

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Ground 2: No Motivation to Combine

1) Silicon Nitride (SiN) is *less suitable* than organic resin for Anzai's planarization layers

79. In fact, I note that a POSITA would have generally *preferred an organic resin for a planarization layer* because it is easier to planarize than silicon nitride. The processes used for depositing organic layers are technically less complicated and less expensive than those used for inorganic layers. For example, organic resins flow more easily to fill out dips in the surface below. Indeed, Yamazaki teaches use of spin coating or ink-jet printing for depositing organic films. Ex. 1004, 2:24-29, 31:14-17. These are simple processes that take advantage of the

liquid state of resin materials prior to hardening or developing. In contrast, silicon nitride is usually deposited via chemical vapor deposition or sputtering and requires additional steps (like chemical mechanical polishing) to make flat. Chemical vapor deposition and sputtering require high vacuum or high temperature conditions and specialized chambers to deposit films. Organic resins are also softer than silicon nitride and are less likely to crack or delaminate. Organic resins can be spin coated and cured at lower temperatures in a normal atmosphere (i.e., air)—a much simpler and less expensive process than chemical vapor deposition or sputtering of silicon nitride. In other words, organic resins are cheaper and easier to planarize than silicon nitride.

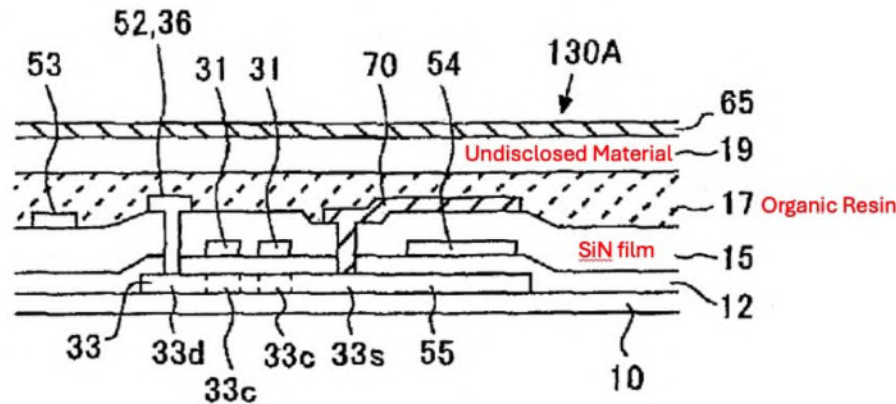
Ground 2: No Motivation to Combine

2) Petitioner asserts in litigation that a silicon nitride layer “serves no purpose”

For the 121/117/222 patents, the accused [REDACTED] serves no purpose in the active area of the display and could be omitted. *See* Hu Deposition Tr.; Yoon Tr. Rough at 227:19-229:23.

Additionally, a silicon nitride film could be used as a gate insulating layer instead of an oxide layer.

Ex. 2014 at 32



POSITA would not make planarization layer 19 out of SiN

POR at 13–14 (annotating Ex. 1003, Fig. 2A)

[REDACTED] Demonstrative Exhibit — Not Evidence

27

Ground 2: No Motivation to Combine

3) No teaching that Yamazaki's SiN is suitable for planarization

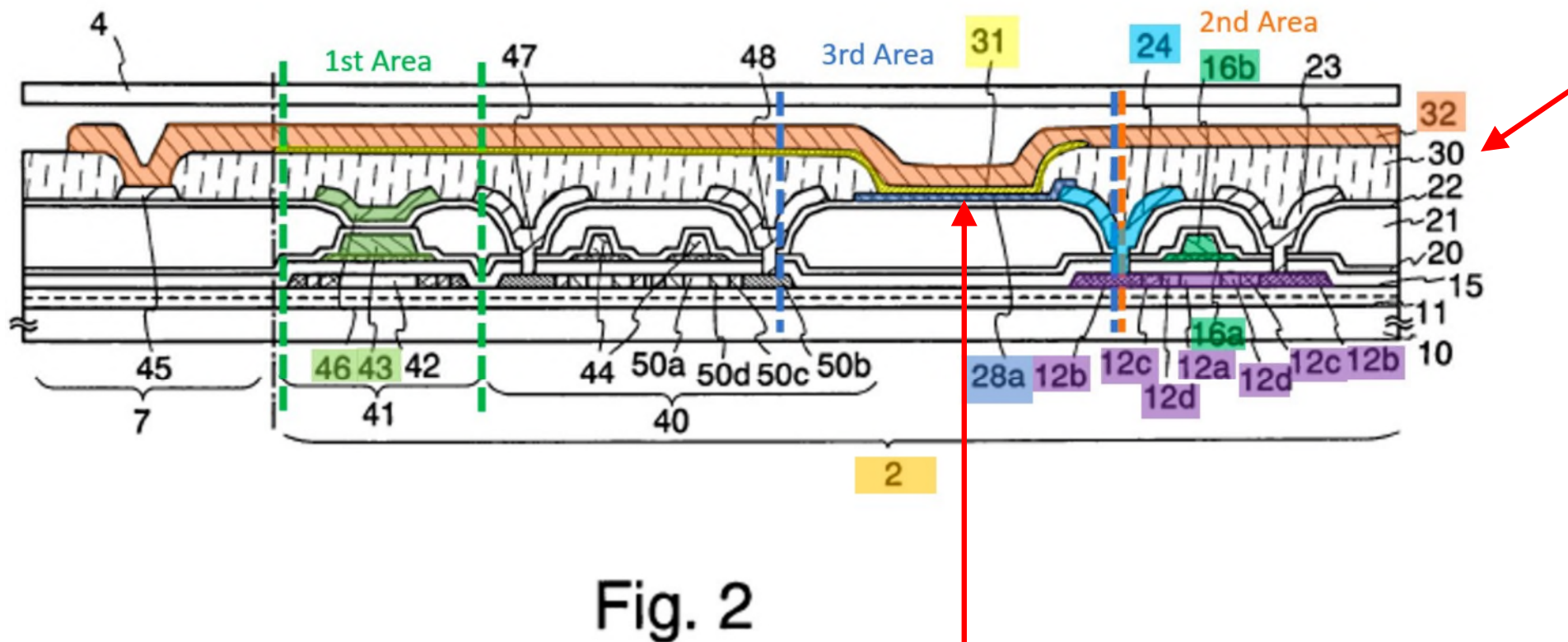
U.S. Patent No. 7,586,121
Petition for *Inter Partes* Review

between cathode 65 and electrodes 53, 52, 70). EX1004, Fig. 2. The top surface of insulation layer 30 is flattened relative to the topology underneath that includes electrodes 46, 47, 48, 24, 23 and insulation film 21 (similar to Anzai's layers 17, 19). *Id.* Yamazaki teaches that silicon nitride is a suitable material for insulation layer 30. *Id.*, 11:45-50. Yamazaki also teaches that the flat top surface of insulation layer 30 can be achieved by CMP (chemical mechanical polish), which can be performed after the formation of insulating material 30. *Id.*, 20:17-24.

It would have been obvious to a POSITA to combine the teachings of Anzai and Yamazaki to use silicon nitride as the material for at least one of the planarization films 17 or 19 of Anzai. EX1002, ¶76.

In addition, for flattening the surface of the first electrode **28a**, any flattening processing such as CMP may be performed after the formation of the first electrode **28a** or after the formation of an insulating material **30**. In the case of performing the CMP processing after the formation of the insulating material **30**, it is preferable to form an interlayer insulation film **22** to increase the adhesiveness between the insulating material **30** and the interlayer insulation film **21**.

Yamazaki Overview



■ Demonstrative Exhibit — Not Evidence

Ex. 1004 (Yamazaki) Fig. 2

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Ground 2: No Motivation to Combine

3) No teaching that Yamazaki's SiN is suitable for planarization

first electrode flat. For instance, before or after the patterning of the first electrode **28a**, the film may be flattened by a chemical or mechanical grinding treatment (typically CMP technology or the like). In the case of performing the CMP, the electrode **24** or the insulating material **30** is provided as a thin film, and the end portion of the electrode **24** is tapered are desirable to improve the flatness of the first electrode.

The insulating material **30** may be a photosensitive or non-photosensitive organic material (such as polyimide, acrylate, polyamide, polyimide amide, resist, or benzocyclobutene), an inorganic material (such as silicon oxide, silicon nitride, or silicon oxynitride) with a CVD method, a sputtering method, or coating method, or a laminate thereof. In the case of using the photosensitive organic material as the insulating material **30**, useful photosensitive organic materials may be roughly grouped into two types. That is, the one is a negative type which becomes insoluble to an etchant by photosensitive light irradiation and the other is a positive type which becomes soluble to the etchant by light irradiation. According to the present invention, both types can be appropriately used.

curvature on its upper end portion. In the case of using a non-photosensitive organic material or inorganic material, the insulating material **330**, **430** becomes one having a cross section shown in FIGS. **4A** and **4B**

Petition relies on Fig. 2A (the wrong embodiment)

Ex. 1004 (Yamazaki) at 11:31–37, 45–58, 62–65

■ Demonstrative Exhibit — Not Evidence

30



Ground 3: Yamazaki / Anzai § 103 (Claims 1–7)

 Demonstrative Exhibit — Not Evidence

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Ground 3: No Motivation to Combine

1) Hindsight On its Face

A POSITA would have understood the issue involved, adding another insulating layer to improve the planarization of the pixel area of Yamazaki. EX1002, ¶120. To address this issue, a POSITA would have been motivated to add planarization layer 19 from Anzai above insulating material 30 of Yamazaki because both insulating layer 30 and planarization layer 19 serve the same purpose of flattening the surface of the pixel area. EX1003, Fig. 2A, 4:8-10 and 4:17-24; EX1004, 11:22-12:52, 20:17-39, Fig. 2; EX1002, ¶120.

The modification to Yamazaki would simply involve deposition another planarization layer on top of an already existing planarization layer (e.g., insulating material 30), which would further improve the flattening purpose of the insulating material 30. EX1002, ¶121. A POSITA would have had reasonable expectation of

Pet. at 46

Ground 3: No Motivation to Combine

1) Hindsight On its Face

A POSITA would have understood the issue involved, adding another insulating layer to improve the planarization of the pixel area of Yamazaki. EX1002, ¶120. To address this issue, a POSITA would have been motivated to add planarization layer 19 from Anzai above insulating material 30 of Yamazaki because both insulating layer 30 and planarization layer 19 serve the same purpose of flattening the surface of the pixel area. EX1003, Fig. 2A, 4:8-10 and 4:17-24; EX1004, 11:22-12:52, 20:17-39, Fig. 2; EX1002, ¶120.

The modification to Yamazaki would simply involve deposition another planarization layer on top of an already existing planarization layer (e.g., insulating material 30), which would further improve the flattening purpose of the insulating material 30. EX1002, ¶121. A POSITA would have had reasonable expectation of

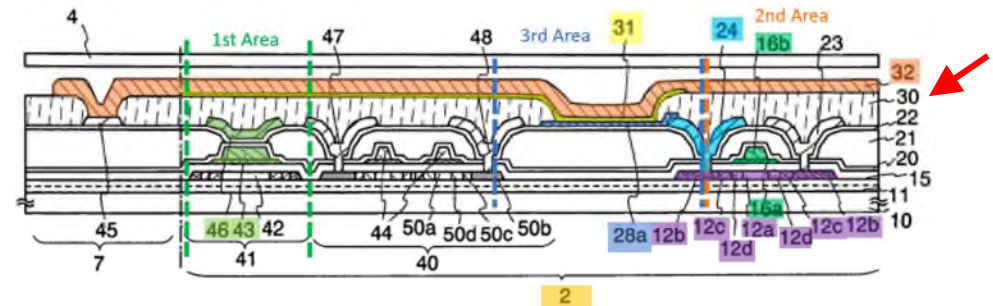


Fig. 2

Ex. 1004 (Yamazaki), Fig. 2 (annotated)

→ unsupported

Pet. at 46

■ Demonstrative Exhibit — Not Evidence

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Ground 3: No Motivation to Combine

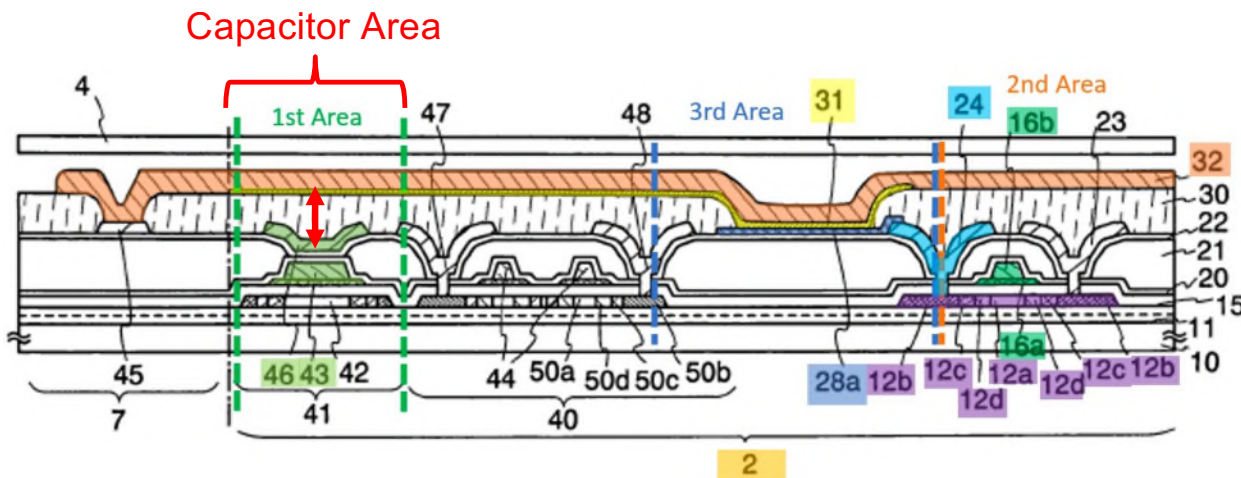


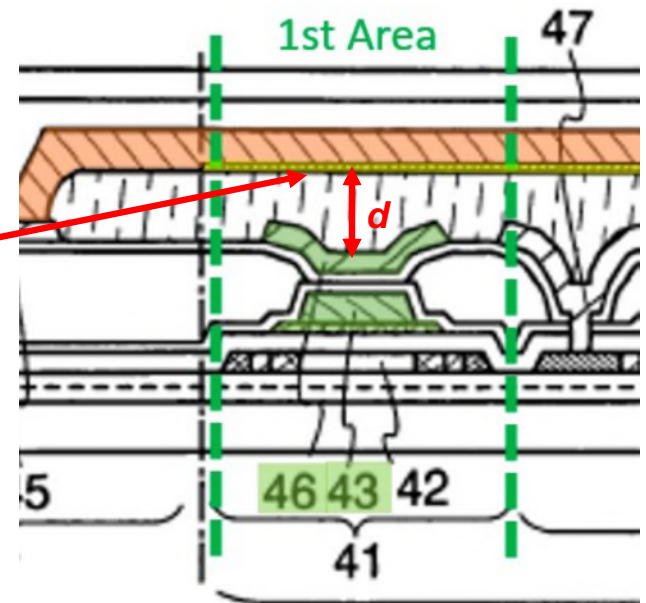
Fig. 2

Formula for capacitance:

$$C = \epsilon \frac{A}{d}$$

(d is distance between plates)

Add Layer Here



Ex. 1004 (Yamazaki), Fig. 2 (annotated)

■ Demonstrative Exhibit — Not Evidence

34

Ground 3: No Motivation to Combine

2) Hindsight: Adding a Layer to Yamazaki **Reduces** Capacitance

30 is already planarized. Adding an additional planarization layer to a layer that is already planarized would not only add manufacturing steps, complications, and cost, but would also reduce capacitive coupling by increasing the thickness. Further,

Ex. 2005 (Bretschneider Decl.), ¶ 85

Formula for capacitance: $C = \epsilon \frac{A}{d}$
(d is distance between plates)

Ground 3: No Motivation to Combine

2) Hindsight: Adding a Layer to Yamazaki **Reduces** Capacitance

Contrary to Petition's hindsight "motivation" in Ground 2:

Additionally, Anzai discloses that both films 17 and 19 are used as the capacitance insulating film. EX1003, 5:65-67. A POSITA would have known that organic materials usually have lower dielectric constants than inorganic materials such as SiN, and a higher dielectric constant is desirable for the insulator in a capacitor since that leads to a higher capacitance per unit area. EX1002, ¶78. That then allows a reduced area storage capacitance element, one of the objectives of Anzai. EX1003, Abstract ("The forming area of the storage capacitance element

Pet. at 26 (proposing a combination of Anzai and Yamazaki)

Ground 3: No Motivation to Combine

3) Hindsight: No Reason to Planarize a Planarized Layer

6 THE WITNESS: There are specifications for all
7 the layers. There's expectations for performance for
8 metrics. Where I am getting stuck is, when you say is it
9 perfectly flat, nothing can be perfectly flat. Everything
10 is made of atoms. There's a technique called atomic force
11 microscopy that you can actually see difference in height
12 because -- are you measuring on top of an atom or a space
13 in between two adjacent atoms?

14 So if you want to go to the limit, we can't make
15 a surface perfectly flat. If it's a planarization layer,
16 it has met planarization requirements. It's met the
17 flatness requirements. There's no reason to improve on
18 meeting the requirements. You don't --

Ex. 1015 (Bretschneider) at 80:6–18

16 So his whole scenario just makes no sense. He's
17 the one who stated, "I want to improve" -- I believe it
18 was "the flattening properties"?

19 There's no reason to improve the flattening
20 properties of a planarization layer unless it's not a
21 planarization layer. Again --

Ex. 1015 (Bretschneider) at 78:16–21

5 Q In your experience in the field, have you ever
6 seen a process flow where the flatness requirement was met
7 using a two-layer technique?

8 MR. CUMMINGS: Objection. Form.

9 THE WITNESS: For a single layer, no.

Ex. 1015 (Bretschneider) at 83:5–9

Ground 3: No Motivation to Combine

3) Hindsight: No Reason to Planarize a Planarized Layer

Anzai's second planarization layer is deposited **on top of intervening layers**

FIG.2A

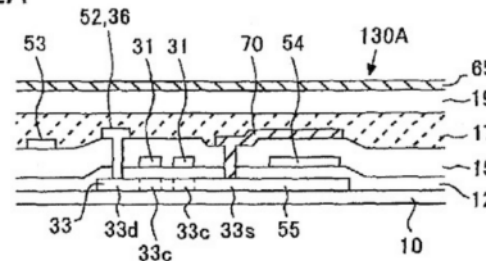


FIG.3A

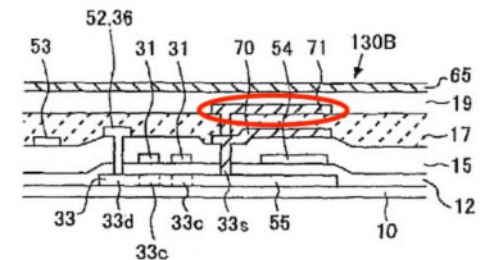


FIG.2B

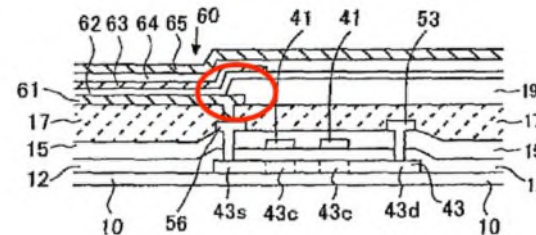
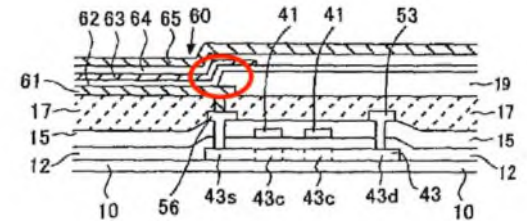


FIG.3B



Not just planarizing a planarized layer

PO Sur-Reply at 21 (annotating Ex. 1003 at Figs 2A–3B)

Ground 3: No Motivation to Combine

4) Hindsight: Petitioner Argues that SiN Capping Layer “Serves No Purpose” and “Could Be Omitted”

It would have been obvious to a POSITA to combine the teachings of Yamazaki and Anzai to add planarization layer 19 from Anzai to be formed on top of insulating material 30, since Yamazaki already teaches using an additional insulation layer (e.g., interlayer insulation film 1431) in a separate embodiment.

EX1002, ¶118.

Pet. at 45

For the 121/117/222 patents, the accused [REDACTED] serves no purpose in the active area of the display and could be omitted. *See* Hu Deposition Tr.; Yoon Tr. Rough at 227:19-229:23. Additionally, a silicon nitride film could be used as a gate insulating layer instead of an oxide layer.

Ex. 2014 at 32

[REDACTED] Demonstrative Exhibit — Not Evidence

39

Petitioner's Inconsistencies

Petitioner in IPR

It would have been obvious to a POSITA to combine the teachings of Yamazaki and Anzai to add planarization layer 19 from Anzai to be formed on top of insulating material 30, as capping layer and passivation layer respectively. EX1002, ¶123. See §VII.C.

Pet. at 47

It would have been obvious to a POSITA to combine the teachings of Yamazaki and Anzai to add planarization layer 19 from Anzai to be formed on top of insulating material 30, since Yamazaki already teaches using an additional insulation layer (e.g., interlayer insulation film 1431) in a separate embodiment. EX1002, ¶118.

Pet. at 45

The modification to Yamazaki would simply involve deposition another planarization layer on top of an already existing planarization layer (e.g., insulating material 30), which would further improve the flattening purpose of the insulating material 30. EX1002, ¶121. A POSITA would have had reasonable expectation of

Pet. at 46

Petitioner in Litigation

In the district court case, Patent Owner identified a [REDACTED] as the claimed capping layer of claims 3 and 4.

Paper 40 (Petitioner Supp. Br.) at 2

For the 121/117/222 patents, the accused [REDACTED] serves no purpose in the active area of the display and could be omitted. See Hu Deposition Tr.; Yoon Tr. Rough at 227:19-229:23. Additionally, a silicon nitride film could be used as a gate insulating layer instead of an oxide layer.

Ex. 2014 (Petitioner Interrogatory response) at 32



Patent Owner's Infringement Positions are Consistent

■ Demonstrative Exhibit — Not Evidence

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Patent Is Consistent – Organic Resins Do Not Passivate

Patent Owner's POR and expert declaration, filed May 7, 2025, explained that **organic resins** do not passivate

actually *do* perform both functions. *See* Ex. 2005, ¶ 72. For example, Anzai's planarization film 17 is made of **organic resin**, which *only* planarizes but does not passivate. *Id.* This is because **organic resin does not passivate**. However, the mere ability of a material to *possibly* be what is claimed does meet the standard for anticipation under Section 102.

Third, an insulator is not inherently a passivation layer. **Organic resin, while it is an insulating material, does not passivate the surface of a semiconductor.** Ex. 2005, ¶ 72. Specifically, organic resin does not tie up dangling bonds, as organic resin lacks the chemical reactivity and appropriate atomic bonding characteristics needed to neutralize the electrically active surface states and dangling bonds. *Id.*; *see generally* Ex. 2008 (describing inorganic passivation materials).

resin. Paper 46 at 1 n.2; EX2016, 11-12. PO's reference to Dr. Neikirk's expert report is inapposite because Dr. Neikirk's report (Sept. 15, 2025) was submitted before PO pivoted from its organic *molecule* theory to its organic *resin* theory in its Sur-Reply (Sept. 17, 2025).

Paper 49 (Petitioner's Reply to Supplemental Information) at 3

POR at 11

■ Demonstrative Exhibit — Not Evidence

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Where is the inconsistency?

Patent Owner in IPR

actually *do* perform both functions. *See* Ex. 2005, ¶ 72. For example, Anzai's planarization film 17 is made of **organic resin**, which *only* planarizes but does not passivate. *Id.* This is because **organic resin does not passivate**. However, the mere ability of a material to *possibly* be what is claimed does meet the standard for anticipation under Section 102.

Third, an insulator is not inherently a passivation layer. **Organic resin, while it is an insulating material, does not passivate the surface of a semiconductor.** Ex. 2005, ¶ 72. Specifically, organic resin does not tie up dangling bonds, as organic resin lacks the chemical reactivity and appropriate atomic bonding characteristics needed to neutralize the electrically active surface states and dangling bonds. *Id.*; *see generally* Ex. 2008 (describing inorganic passivation materials).

POR at 11

Patent Owner in Litigation

“The accused [REDACTED] passivates.”

Never stated – No citation – No Inconsistency

“All [REDACTED] always inherently passivates”

Never stated – No evidence – No Inconsistency

No Evidence for Petitioner's Assumption

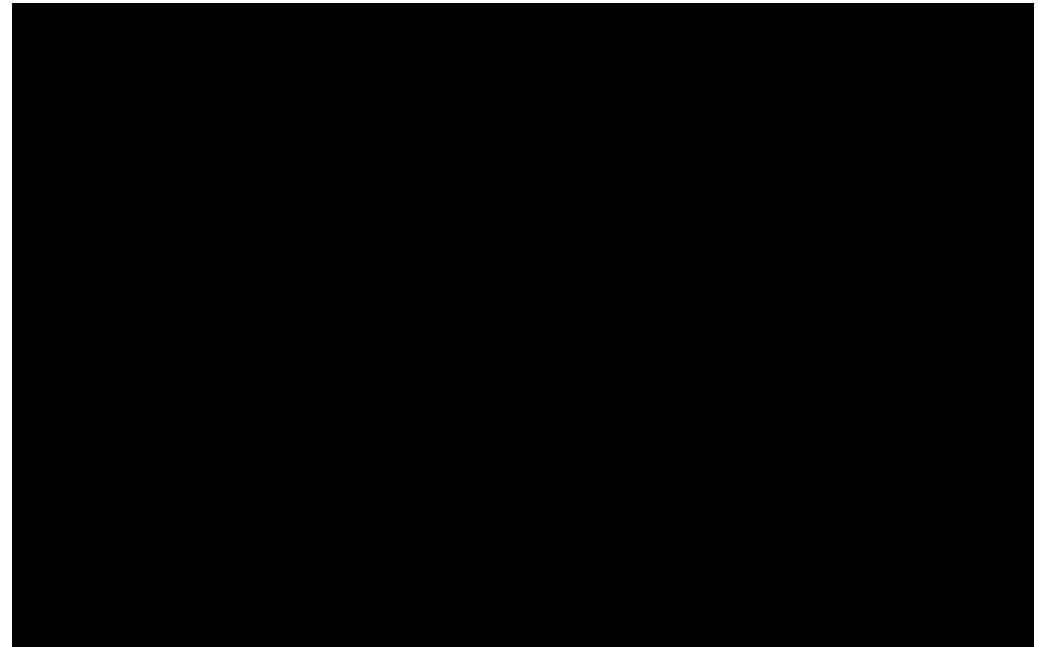
Petitioner's alleged inconsistency

In direct contradiction, PO accuses Petitioner's [REDACTED]
[REDACTED] as the claimed "passivation layer" in the related litigation.

EX1023, at pp. 137-138 (PO's infringement expert's report).¹ The report states that

Paper 41 (Petitioner's Supp. Br.) at 2

Patent Owner in Litigation



Ex. 1023 at 137-138

It does not even mention "organic resin"

[REDACTED] Demonstrative Exhibit — Not Evidence

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Patent Owner is Consistent

“[O]nly those terms need be construed that are in controversy, and only to the extent necessary to resolve the controversy.”

Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc., 200 F.3d 795, 803 (Fed. Cir. 1999).

- Petition relies on overbroad, incorrect definitions of “passivation” and “capping”
- Petitioner’s own dictionary definitions prove this

Patent Owner's Position Never Changed

Patent Owner has always maintained that **organic resins** do not passivate. Petitioner's reply *E.g.*:

Third, an insulator is not inherently a passivation layer. Organic resin, while it is an insulating material, does not passivate the surface of a semiconductor. Ex. 2005, ¶ 72. Specifically, organic resin does not tie up dangling bonds, as organic resin lacks the chemical reactivity and appropriate atomic bonding characteristics needed to neutralize the electrically active surface states and dangling bonds. *Id.*; *see generally* Ex. 2008 (describing inorganic passivation materials).

POR at 11

72. I also note that a planarization layer is not the same thing as a passivation layer, and that not all insulators are passivating materials, which is contrary to the apparent assertions of Dr. Neikirk. Ex. 1002, ¶¶61–65. For example, Anzai, the very reference Dr. Neikirk identifies, is an **organic resin** material that only planarizes—it does not passivate. Further, while organic resin is an insulator, it does not passivate because lacks the chemical reactivity and atomic bonding characteristics needed to neutralize the electrically active surface states and tie up dangling bonds. An organic resin may form physical bonds with a surface, but does not form chemical bonds with a surface. As discussed above, organic resins are molecular mixes and do not possess free or unbonded electrons which would enable it to act as a passivation material. A POSITA would know this.

Ex. 2005, ¶ 72

Dr. Bretschneider's Deposition Confirms His Declaration and the POR

13 THE WITNESS: I'm unaware of an organic resin
14 used as a planarization film that would serve as a
15 passivation layer. Dr. Neikirk did not give any specific

Ex. 1015 at 54:13–16

20 Q So, here, they're saying the -- an organic
21 dielectric layer can serve as a passivation layer; right?

22 MR. CUMMINGS: Objection. Form.

23 THE WITNESS: I have to point out, the language
24 here is organic dielectric, not organic resin. And,

Ex. 1015 at 57:20–58:9

22 Q Can a layer of organic resin, as contemplated by
23 Anzai, be an organic compound?

24 MR. CUMMINGS: Objection. Form.

25 THE WITNESS: The best I could say is that the
1 resin could contain organic compounds. The issue is their
2 resin is a mixture. So it's not a compound.

Ex. 1015 at 66:22–67:1

18 Q But it's your opinion that no matter what organic
19 material Anzai selects for that planarization layer, the
20 material cannot serve as a passivation layer?

21 MR. CUMMINGS: Objection. Form.

22 THE WITNESS: It's my opinion that the teachings
23 of Anzai and the understanding and opinions expressed by
24 doc -- by Dr. Neikirk say those materials are not -- you
25 can't call them passivation layers.

2 Q No matter what organic material is selected; is
3 that right?

4 MR. CUMMINGS: Objection. Form.

5 THE WITNESS: You're saying no matter what
6 organic material, but Anzai talks about using organic
7 resins, which is a much smaller range of selection of
8 materials.

Ex. 1015 at 52:18–53:8

Liaw Shows that [REDACTED] is used differently

While [REDACTED] **can be** an organic resin (insulation material),
not all [REDACTED] is an organic resin (passivation material)

PI Resin: No Passivation

Ex. 2015 at 941

Ex. 2015 at 965

Petitioner's assertion that [REDACTED] is **always inherently** an organic resin is not supported by any evidence

[REDACTED] Demonstrative Exhibit — Not Evidence

48

So many different [REDACTED]

While [REDACTED] can be an organic resin (insulation material),
not all [REDACTED] is an organic resin (passivation material)

A B S T R A C T

Polyimides rank among the most heat-resistant polymers and are widely used in high temperature plastics, adhesives, dielectrics, photoresists, nonlinear optical materials, membrane materials for separation, and Langmuir–Blodgett (LB) films, among others. Additionally, polyimides are used in a diverse range of applications, including the fields of aerospace, defense, and opto-electronics; they are also used in liquid crystal alignments, composites, electroluminescent devices, electrochromic materials, polymer electrolyte fuel cells, polymer memories, fiber optics, etc. Polyimides derived from monomers with non-coplanar (kink, spiro, and cardo structures), cyclic aliphatic, bulky, fluorinated, hetero, carbazole, perylene, chiral, non-linear optical and unsymmetrical structures have been described. The syntheses of various monomers, including diamines and dianhydrides that have been used to make novel polyimides with unique properties, are reported in this review. Polyimides, with tailored functional groups and dendritic structures have allowed researchers to tune the properties and applications of this important family of high-temperature polymers. The synthesis, physical properties and applications of advanced polyimide materials are described.

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Ex. 2015

Petitioner's assertion that [REDACTED] is **always inherently** an organic resin is not supported by any evidence

Patent Owner Did Not Shield Dr. Fontecchio

Dr. Fontecchio issued a validity report in the District Court case, including, *e.g.*:

64. Dr. Neikirk also responds to Optronic's argument and Dr. Bretschneider's testimony about the meaning of "passivation layer" in the IPR. Neikirk Rep. at ¶¶ 151-156. Many of Dr. Neikirk's criticisms apply equally to his overbroad construction. For example, Dr. Neikirk criticizes Dr. Bretschneider's opinion for not having direct intrinsic evidence support. But there is no intrinsic evidence support for the opinion that a passivation layer is any layer that provides physical protection, which is very broad and could apply to many different types of layers. Dr. Neikirk also criticizes Dr. Bretschneider for relying on a single dictionary. But none of the dictionaries cited by Dr. Neikirk support his opinion, as I discuss above. The citation to three dictionaries is irrelevant when none of them support his opinion.

65. I find Dr. Neikirk's citation to questioning of Dr. Bretschneider at deposition about tying up dangling bonds of the ILD layer to be particularly confusing and inconsistent with the knowledge of a POSITA. *See* Neikirk Rep. at ¶ 156. An ILD layer, as Dr. Neikirk surely is aware, is not a conductive layer and would not have dangling bonds. The metal layers that the passivation layer in the '121 patent are deposited on, however, would have such dangling bonds. It is these dangling bonds that indicated to a POSITA that the specification is talking about a passivation layer. And tying up these dangling bonds is important to avoid short circuits for devices and improve performance. *See, e.g.,* Monch, *Semiconductor Surfaces and Interfaces* at 340 (2nd Ed. 1995).

66. Accordingly, I disagree with Dr. Neikirk's opinion about the plain meaning of "passivation layer."

■ Demonstrative Exhibit — Not Evidence

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Thank you.