

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

SAMSUNG DISPLAY CO., LTD.
Petitioner,

v.

PICTIVA DISPLAYS INTERNATIONAL LTD.,
Patent Owner.

Case No. IPR2024-01222
Patent No. 6,949,389

PATENT OWNER SUR-REPLY

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EXHIBIT LIST

Exhibit No.	Document Description
EX2001	Declaration of Mr. Kurt Humphrey in Support of POPR
EX2002	Declaration of Dr. E. Fred Schubert on behalf of Samsung Electronics Co., Ltd. et al. in <i>Pictiva Displays Int'l Ltd. v. Samsung Electronics Co. Ltd.</i> , et al., Case No. 2:23-cv-000495 (Nov. 12, 2024)
EX2003	Samsung's Notice of Corrected Exhibit B to Joint P.R. 4-3 Statement in <i>Pictiva Displays Int'l Ltd. v. Samsung Electronics Co. Ltd.</i> , et al., Case No. 2:23-cv-000495, Dkt. 110 & 110-1 (E.D. Tex. Nov. 13, 2024)
EX2004	Samsung's Proposed Claim Constructions for the Terms and Phrases Identified for Construction per Local Rule 4-2 in <i>Pictiva Displays Int'l Ltd. v. Samsung Electronics Co. Ltd.</i> , et al., Case No. 2:23-cv-000495 (E.D. Tex. Oct. 22, 2024)
EX2005	omitted
EX2006	389 Invention Disclosures
EX2007	U.S. Patent Application No. 2003/0054579A1 to Pakbaz et al.
EX2008	U.S. Patent Application No. 2003/0052616A1 to Antoniadis et al.
EX2009	U.S. Patent Application No. 2004/009304A1 to Pichler et al.
EX2010	U.S. Pat. No. 7,121,642 to Stoessel et al.
EX2011	U.S. Pat. No. 6,702,419 to Stoessel et al.
EX2012	Seog Soon Kim et al., <i>Ultra-high Precision Inkjet Printing Technology for Display</i> , 64-1 SID 2018 Digest, 839-842 (2018), available from https://sid.onlinelibrary.wiley.com/doi/abs/10.1002/sdtp.12244 (last visited Dec. 10, 2024)
EX2013	Lorentz Force downloaded from https://en.wikipedia.org/wiki/Lorentz_force (last visited Dec. 10, 2024)
EX2014	Docket Control Order in <i>Pictiva Displays Int'l Ltd. v. Samsung Electronics Co. Ltd.</i> , et al., Case No. 2:23-cv-000495, Dkt. 40 (E.D. Tex. Apr. 17, 2024)
EX2015	Federal Court Management Statistics for U.S. District Courts, available from https://www.uscourts.gov/statistics/table/na/federal-court-management-statistics/2024/06/30-1

Exhibit No.	Document Description
EX2016	Samsung Invalidity Contentions in <i>Pictiva Displays Int'l Ltd. v. Samsung Electronics Co. Ltd., et al.</i> , Case No. 2:23-cv-000495 (E.D. Tex. Jun. 11, 2024)
EX2017	Stephen J. Matthews, <i>Back to Basics: Organic LEDs</i> , Laser Focus World (Jul. 31, 2001), downloaded from https://www.laserfocusworld.com/lasers-sources/article/16556776/back-to-basics-organic-leds (last visited Dec. 10, 2024)
EX2018	<i>Sotera</i> Stipulation
EX2019	Markman Hearing Transcript in companion district court case, <i>Pictiva Displays Int'l Ltd. v. Samsung Electronics Co. Ltd., et al.</i> , Case No. 2:23-cv-000495 (E.D. Tex. Feb. 4, 2024)
EX2020	2025-05-30 Deposition Transcript of Dr. Vivek Subramanian
EX2021	2025-05-31 Deposition Transcript of Dr. Vivek Subramanian
EX2022	U.S. Patent No. 6,590,157 to Boroson et al.
EX2023	Steven Molesa et al., “High-quality inkjet-printed multilevel interconnects and inductive components on plastic for ultra-low-cost RFID applications,” <i>Mat. Res. Soc. Symp. Proc.</i> Vol. 769, H.8.3.1-H8.3.6 (2003)
EX2024	Jin-Seong Park et al., “Thin film encapsulation for flexible AM-OLED: a review,” <i>Semicond. Sci. Technol.</i> 26, 034001 (2011)
EX2025	Daniel Huang et al., “Plastic-Compatible Low Resistance Printable Gold Nanoparticle Conductors for Flexible Electronics,” <i>Journal of The Electrochemical Society</i> , 150 (7), G412-G417 (2003)
EX2026	Wenbo Zhou et al., “Experimental Study on Viscosity of Colloidal Silica in Aqueous Electrolytic Solutions,” <i>Journal of Dispersion Science and Technology</i> , 29:842-847 (2008)
EX2027	Junhui He et al., “Preparation of Porous and Nonporous Silica Nanofilms from Aqueous Sodium Silicate,” <i>Chem. Mater.</i> , 2003, 15, 3308-3313 (2003)

Exhibit No.	Document Description
EX2028	Kyoung-Min Kim et al., “Surface treatment of silica nanoparticles for stable and charge-controlled colloidal silica,” <i>International Journal of Nanomedicine</i> 2014:9 (Suppl 2) 29–40 (2014)
EX2029	reserved for IPR2024-01222, 389 Invention Disclosures for IPR2024-01223
EX2030	Lorenza Moro et al, “Large-Scale Manufacturing of Polymer Planarization Layer,” <i>informationdisplay.org</i> , 10-15 (March/April 2021), available from https://sid.onlinelibrary.wiley.com/doi/epdf/10.1002/msid.1194 (last visited Jun. 20, 2025)
EX2031	[Under Seal], Deposition Transcript of Dr. Homer Antoniadis in <i>Pictiva Displays Int’l Ltd. v. Samsung Electronics Co. Ltd., et al.</i> , Case No. 2:23-cv-000495 (E.D. Tex. Jun. 4, 2025)
EX2032	Deposition Exhibit 5 to Dr. Antoniadis’s deposition, Final Technical Progress Report Polymer OLED White Light Development Program – (#DE-FC26-04NT41947)
EX2033	reserved
EX2034	Jeff Hebb of Kateeva, “Advanced Inkjet Printing: Enabling the OLED Revolution” (Sept. 28, 2017), available from https://nccavs-usergroups.avs.org/wp-content/uploads/TFUG2017/TFUG917-3-Hebb.pdf (last visited June 15, 2025)
EX2035	Roll to Roll (R2R) Processing Technology Assessment, Pre-decision draft, available from Available from https://www.energy.gov/sites/prod/files/2015/02/f19/QTR%20Ch8%20-%20Roll%20To%20Roll%20Processing%20TA%20Feb-13-2015.pdf (last visited June 15, 2025)
EX2036	Chandra Kant et al., “Large area inkjet-printed OLED fabrication with solution-processed TADF ink,” <i>nature communications</i> (2023)
EX2037	P.E. Burrows et al., “Gas Permeation and Lifetime Tests on Polymer-Based Barrier Coatings,” <i>Proceedings of SPIE</i> Vol. 4105, 75-83 (2001)
EX2038	Screenshot of https://global.samsungdisplay.com/31159 , “[Learn Display] 100. Inkjet Printing” by Samsung Display
EX2039	[Under Seal] Pictiva 80x48 display product specification

Exhibit No.	Document Description
EX2040	U.S. Patent No. 6,605,483 to Add-Vision, Inc.
EX2041	U.S. Patent No. 7,115,216 to Add-Vision, Inc.
EX2042	U.S. Patent Application Publication No. 2008/000889 to 3M
EX2043	Patrick Stark et al., “OLED – Evaluation and clarification of the new Organic Light Emitting Display technology,” Department of Science and Technology, Linkopng University, Sweden (Mar. 11, 2002), available from https://www.diva-portal.org/smash/record.jsf?pid=diva2%3A18218&dswid=4057 .
EX2044	U.S. Patent No. 6,337,222 to Shimoda
EX2045	Screenshot of https://kateeva.com/solutions/technology/why-inkjet/ (last visited June 20, 205)
EX2046	Declaration of Mr. Kurt Humphrey in Support of POR
EX2047	Declaration of Mr. Kurt Humphrey in Support of IPR2024-01223 POR
EX2048	District Court Claim Construction Order
EX2049	2025-10-30 Deposition Transcript of Dr. Vivek Subramanian
EX2050	2025-10-31 Deposition Transcript of Dr. Vivek Subramanian
EX2100	Conor Madigan, “Inkjet Technology for OLED SSL Mass Production,” (Jan. 28, 2015), available from https://energy.gov/sites/prod/files/2015/02/f19/brown-madigan_inkjet_sanfrancisco2015.pdf .

For reasons stated below and in the POR, the Board should uphold the claims.

I. Claim Construction

A. “Planarization Layer”

The Board should adopt the District Court’s claim construction for “planarization layer,” which is based on Samsung’s proposed construction and consistent with the intrinsic evidence. EX2048, 18-19.

The parties agreed that interrupting defect propagation and not reproducing underlying topology are distinct features. EX2019, 36-38; POR 20-21. In the district court, Samsung argued that the requirement for not reproducing underlying topography is to prevent creating “folds and creases” in the barrier layer formed over the organic layer. *Id.*, 36:13-37:16. It characterized this aspect of the requirement as “providing a *substantially smoother* surface.” *Id.*, 38:13-20.

In contrast, the requirement for interrupting defect propagation originated from the disclosure in “Applicants’ specification at page 7, lines 16-21,” which became 4:33-41, part of “DETAILED DESCRIPTION OF THE INVENTION.” EX1002, 371; *compare* EX1002, 52 *with* EX1001, 3:39-40, 4:33-41.

B. “Selectively Depositing”

Samsung argues that the Board should ignore its proposed construction because the District Court did not adopt it. Reply 1. But Petitioner prevailed on its non-infringement argument that it did not perform selective deposition because [REDACTED]

[REDACTED]

[REDACTED]. The Board

should thus hold Samsung to its implicit construction to avoid inconsistency.

II. Grounds I-II Fails

A. The Grounds Improperly Rely on AAPA as Bases

Unlike *Shockwave*, the Petition expressly states that it is “based” on AAPA and/or Ghosh. *See* Reply 9 (images reproduced below). Consequently, *Qualcomm II* governs.

Ground	Reference(s)	Challenged Claims
1	§ 103 Levy as modified by AAPA in combination with Mantell, Uchiyama or Willneff	1-6, 11, 14-16
2	§ 103 Levy as modified by AAPA in combination with Mantell, Uchiyama or Willneff, and in further view of Hayes	7, 12
3	§ 103 Levy as modified by AAPA in combination with Mantell, Uchiyama or Willneff, and in	8, 12

Shockwave petition
(IPR2019-00405, Paper 1)

III. SUMMARY OF CHALLENGE
Petitioner requests IPR based on the following grounds:
<ul style="list-style-type: none"> • Ground I: Claims 34, 35, 37, and 40 are obvious over Yamazaki in view of the applicant admitted prior art (“AAPA”) and/or Ghosh; • Ground II: Claims 41-46 are obvious over Yamazaki in view of AAPA/Ghosh and Fujimori;

Petition here

B. The Combinations Lack Multiple Limitations

1. Yamazaki does not teach a “planarization layer” as properly construed

Petitioner relies solely on Yamazaki for “planarization layer” in Grounds 1-2. But the Petition never analyzed the references under Samsung’s proposed construction in the district court or explained why it applied a different construction here, as required under Rule 104(b)(3)-(4). *See* Pet. 27; EX2020, 18:4-18, 212:9-213:9 (Samsung expert did not apply the district court’s construction); Paper 9 (Petitioner sought a sur-reply in January 2025, without attempting to explain its inconsistent claim construction positions); Paper 12, 11-12 (the Board declined to

adopt Samsung’s proposed district court construction because “*Petitioner has not proposed the same constructions here*”).

The fatal omission cannot be cured by untimely gap-filling raised for the first time in the Reply because “a petition ... may be considered only if” it meets all the requirements under 35 U.S.C. §312(a), including by providing “such other information as the Director may require by regulation” (e.g., 37 C.F.R. §42.104(b)(3)-(4)).

The inconsistent claim construction positions warrant rescission of the institution decision. *See Revvo Technologies, Inc. v. Cerebrum Sensor Technologies, Inc.*, IPR2025-00632, Paper 20 (Squires November 3, 2025) (vacating institution decision where the petitioner proposed different claim constructions before a district court and the PTAB without explanation).

The new arguments also fail on the merits. Dr. Subramanian does not contend PMLs inherently or even generally include a planarization layer. EX2050-2025-10-31_Subramanian, 68:16-70:9. Yamazaki also does not mention defects or defect filling. *Id.*, 10:7-13, 24:24-25:1, 27:2-28:5. Instead, Yamazaki addresses moisture/oxygen permeation by using “a material that ... is unlikely to allow[] substances such as moisture and oxygen to permeate.” EX1005, [0178]; POR 28-29; EX2046, ¶¶43-44. Petitioner does not dispute this characterization.

Citing to Suzuki, Petitioner nevertheless argues that “a POSITA would

recognize that the ‘planarity’ of Yamazaki’s cover layer would ensure that defects will be filled in or smoothed over and thereby not propagated.” Reply 12; *see also* EX2050_2025-10-31_Subramanian, 10:15-13:25, 17:23-18:17 (citing Suzuki to link planarity and defects). But Suzuki is not Yamazaki, and they do not have identical material sets, manufacturing methods, or even needs. EX2050_2025-10-31_Subramanian, 18:18-20:10; Reply 14 (distinguishing Yamazaki and Suzuki based on “the specific needs of Suzuki”). Thus, that Suzuki’s cathodes may inevitably have defects that need to be covered by an organic layer does not mean the same is true for Yamazaki. EX2050, 24:24-25:1. As Dr. Subramanian acknowledges, Suzuki is not part of the ground (EX2050_2025-10-31_Subramanian, 17:23-18:17); and any argument that defect filling and interruption of defect propagation are “obvious” (Reply 12) amounts to an improper new theory raised for the first time in Reply that should be disregarded.

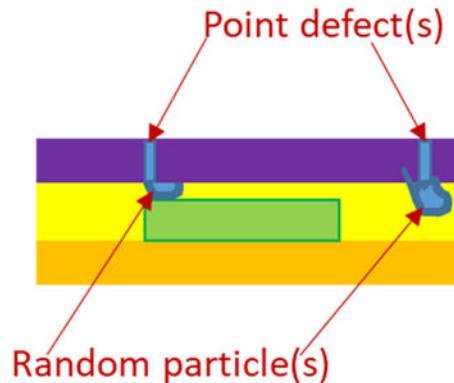
Moreover, Dr. Antoniadis, a purported expert in OLEDs retained by Samsung, testified:

[T]he thin film encapsulation includes also an organic layer. And ***when you put the organic layer down, you introduce particles and managing these particles could be an issue.***

EX2031, 40:25-41:4, 58:22-24. Dr. Antoniadis testified that the industry struggled with this particle generation. *Id.*, 41:5-6. Petitioner does not dispute these facts

(EX2050, 127:24-128:17), or explain how defects can be interrupted

notwithstanding this particle generation (*see* illustration below).



Petitioner suggests that Mr. Humphrey’s testimony implies a claimed “planarization layer” is inherent in PMLs. Reply 12-13. Not so. There, he was discussing whether a POSITA would recognize that the inventors were in possession of the concept of “planarization layer.” EX1035, 82:3-83:18, 78:17-79:4, 72:18-73:7. That is why Mr. Humphrey stated “*In conception* I believe yes.” *Id.*, 82:22-83:4. The “known” function of the polymer multilayers and thin-film encapsulation in Mr. Humphrey’s answer refers to disclosures in the intrinsic evidence, and not to prior art. EX2046, ¶154 (“the reference to ‘PML’ and *the inventors’ general understanding of the structures and functions of ‘PML’* indicates that the inventors had conceived the concept of an organic ‘planarization layer’ as part of their conception”); *see also* ¶¶35-37, 115-117 (disagreeing that Yamazaki and Weaver disclose “planarization layer”).

Petitioner argues that Suzuki's teaching of defect filling applies to Yamazaki, but the minimum layer thickness specified in Suzuki "relates to the specific needs of Suzuki" and does not apply to Yamazaki. Reply 14. Petitioner, however, presents no evidence that the disclosed 10-300nm thickness range for Yamazaki's cover layer in the relevant structures would be sufficient to interrupt defect propagation. Reply 14; EX1032, ¶¶13-19.

For example, Dr. Subramanian testified that Yamazaki's OLED would have a 110nm thick anode (ITO), a typically 100-120nm thick EL layer and a typically 200-250 nm thick cathode, for a total thickness of 410-480 nm. EX1005, [0129], [0139]; EX2050_2025-10-31_Subramanian, 32:6-33:24. Mr. Humphrey observed, Yamazaki's thickness range of 10-300nm "would be too thin to fully encapsulate particulates that could occur in manufacturing." EX2046, ¶43. Petitioner presents no evidence to dispute that conclusion.

Petitioner also argues that "Yamazaki teaches that its cover layer may readily be made thicker if necessary." Reply 14; EX1032, ¶16. But the cited Yamazaki [0090] is associated with embodiment 1, which, unlike the configurations in Figures 11 and 14, deposits the cover layer above (not below) the barrier layer. EX2050_2025-10-31_Subramanian, 40:6-43:2; Yamazaki, [0044], [0068], [0090]. The disclosure is therefore inapposite.

Additionally, Yamazaki [0090] involved the use of electrical field application

method, and not inkjet printing method relied on for claim 35. Pet. 32; Yamazaki, [0044], [0068], [0090], [0176]-[0178]; EX2050_2025-10-31_Subramanian, 44:23-46:3; *see also* 46:14-47:22.

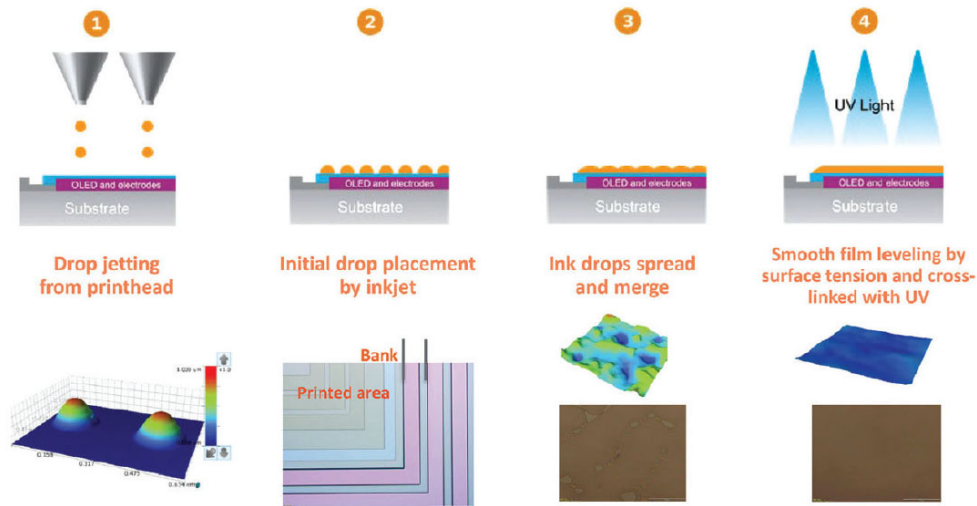
For inkjet printing, Petitioner cites EX1032, ¶¶17-19, which in turn rely on EX2023, EX1029, and EX1028 for the alleged capability of depositing a thicker planarization layer over a large area. Reply 14-15; EX1032, ¶¶17-19. But EX2023, EX1029, and EX1028 were each published after the filing date of the 389 patent, (EX2050_2025-10-31_Subramanian, 52:11-57:18),¹ and have nothing to do with depositing an organic encapsulant for OLEDs, (*id.*, 95:14-97:16).² Petitioner thus has not shown that a POSITA with but one year of experience would have known how to make the cover layer thicker.

The Reply also downplays the difficulty of using inkjet printing to print a planarization layer over a relatively large area, arguing that inkjet printing scales well to large areas, allegedly “because of the ability to use a large number of head

¹ EX2023 (2003); EX1029 (2004); Ex. 1 to EX2050_2025-10-31_Subramanian (EX1028 was published in Nov. 2002).

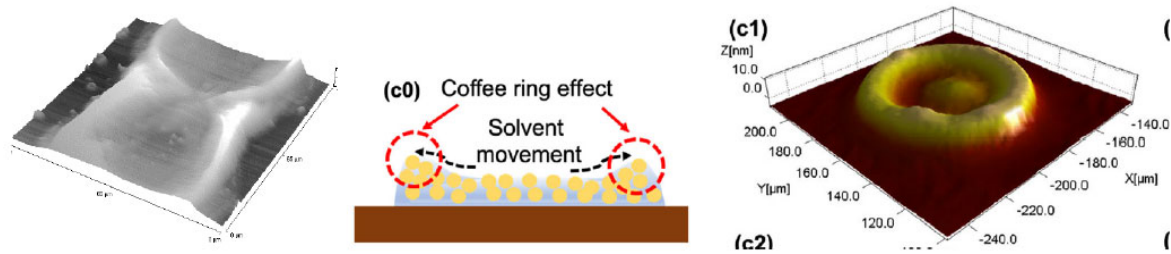
² EX1029 relates to inkjet printing an EL layer, which Petitioner acknowledges is different from printing an encapsulant layer. Reply 27 (discounting Sturm because it “was focused on depositing an EL layer, not an encapsulation layer”).

sin parallel.” EX1032, ¶19 (cited on Reply 15). That strawman argument does not address Mr. Humphrey’s reasoning for why the much larger cover layer would be far more likely than an EL pixel to experience “defects in the film, such as non-planarity, pinholes, cracks etc., *e.g.*, because it becomes more likely that ***not all the droplets spread and merge properly*** and/or because it ***becomes more difficult for the entire film to level***” as the print area increases. EX2046, ¶¶65-67.³ These defects are formed in steps 3-4 after the dispensing step (*see below*) and Petitioner does not explain how the number of printer heads would address the problem. POR 29-30.



(EX2030, Figure 2; *see also* EX2034, p.16)

³ The '389 patent addresses this problem by using UV-curable monomer liquids that did not need solvents. EX1001, 6:61-62; EX2046, p.31 n.9; POR 37 n.3.



(EX2023, Fig. 2; EX2036, Figs c0-c1 (coffee-rings over 0.1mm×0.1mm areas, no evidence that coffee rings could be substantially eliminated over a display that is 3+ orders of magnitude larger); *see also* EX2031-Antoniadis (Samsung expert), 136:16-17 (“Inkjet printing cannot do a large area uniformly”).

As to the “precision” issue, that is specific to the EL layer, and does not concern whether Yamazaki’s cover layer is a planarization layer. Instead, that issue relates to whether it would be obvious to extend Yamazaki’s methods to multiple devices on a substrate, as explained on POR 34-36 and further below.

Simply put, Petitioner’s unsupported expert testimony and inapposite references do not show that Yamazaki’s cover layer can interrupt defect propagation from Yamazaki’s cathode to its barrier layer to qualify as a claimed planarization layer.

2. None of Yamazaki, AAPA or Ghosh teach selectively depositing a barrier layer over multiple devices

The claims are directed to encapsulating a plurality of devices (*see* EX1001, claims 34-35, 41) and Yamazaki relates to “manufacturing OLED display panels”

(*see* Pet. 17-18). Thus, Petitioner must show, *inter alia*, that selectively depositing a barrier layer over the multiple OLED devices on a substrate was known and that a POSITA would have extended Yamazaki's method to multiple devices. *See* claims 34-35, 41. That is, it is insufficient for Samsung to merely argue that fabricating multiple devices on a substrate was known (*see* Reply 15-16).

Yet, as previously explained, none of the three references teach “selectively depositing at least one barrier layer over said planarization layer” that is in turn selectively deposited on the multiple devices (*see* claims 34, 41), “because Yamazaki does not disclose [encapsulating] multiple devices on a substrate and AAPA and Ghosh both disclose non-selective deposition of the barrier layer.” POR 1, 31-32. The Reply does not dispute that the prior art does not disclose this material limitation, but argues that matters not because “the Petition specifically relied upon Ghosh for its teachings relating to batch fabrication, not for its teachings on depositing a barrier layer.” Reply 16. But while common knowledge may be used to fill a missing limitation “if the limitation in question was unusually simple and the technology particularly straightforward,” *Arendi S.A.R.L. v. Apple Inc.*, 832 F.3d 1355, 1361-62 (Fed. Cir. 2016), here the selective deposition over multiple devices is a material limitation and part of the improvement over prior art. *See* EX1001, 2:17-29, 2:65-3:5. Petitioner therefore must show where in the prior art such a step was known, a burden Petitioner has not carried.

The alleged benefits of batch manufacturing—“reduce[d] costs, increase[d] throughput, and increase[d] yield”—does not explain why a POSITA would have looked to Yamazaki for methods of depositing a barrier layer over multiple devices while ignoring AAPA and Ghosh’s consistent teaching of non-selective deposition of barrier layers over multiple devices, even when organic layers were deposited selectively as in Ghosh. Reply 15-19; Ghosh, [0032]; EX1003, ¶58; EX2050_2025-10-31_Subramanian, 77:19-79:20. In that respect, an allegation that “a POSITA would have appreciated that Yamazaki’s method *may be readily applied to* encapsulate a plurality of OLED devices on a large sheet of substrate” (Pet. 22-23) shows at most that Yamazaki’s method *could be* used, not that they *would be* used. *Belden Inc. v. Berk-Tek LLC*, 805 F.3d 1064, 1073 (Fed. Cir. 2015).

Additionally, unlike embodiment 3, where selective deposition was specifically “note[d],” Yamazaki does not state that the barrier layers in its embodiments 1, 2 and 4 are selectively deposited. *Compare* EX1005, [0089], [0141], [0201] *with* [0183]; EX2050_2025-10-31_Subramanian, 65:17-67:13; EX1009_Burrows, Figs. 2-4 & 8:48-67 (non-selective deposition followed by masked etching along the edges to form wrapped PML structures similar to Ghosh Fig. 3). The prior art therefore generally shows non-selective deposition of barrier layers except where specified; but nothing in Yamazaki or references in the record suggests that Yamazaki’s method should be extended to multiple devices.

Additionally, given Samsung's implicit construction of "selectively depositing," it must, but does not, show that there is affirmatively no removal of any of the deposited materials in the masked deposition of embodiment 3.

C. The Reply Still Does Not Explain Why a POSITA Would Have Extended Yamazaki's Method to Multiple Devices

The Reply treats the Board's preliminary findings at the institution stage as if they were final. Reply 17. But at the time, the Board did not adopt the district court's claim construction or was informed that prior art did not teach selectively depositing a barrier layer when multiple devices were involved. Nor did the Board consider Yamazaki's unique design principle that requires "using a same film deposition method to form the EL layer and the cover layer." EX1005, abstract; *see also id.*, [0035] ("because the same method is used in forming the EL layer and the cover layer,"); [0068] & [0090] (EL and cover layer both formed with the electric field application method in embodiment 1); [0131] & [0142] (same in embodiment 2); [0176]-[0177] (EL and cover layer both formed with the inkjet method in embodiment 3); [0202] (cover layer "is subsequently formed by the same method used for forming the EL layer" in embodiment 4); POR 34-37. Nor was the Board presented with evidence that a POSITA, in light of the immaturity of the specific methods at the time of the invention, would not have chosen them for batch fabrication. POR 34-38.

The Reply does not meaningfully engage these arguments. Reply 17-19. Instead, it dismisses them because the '389 patent allegedly does not express similar concerns. But the '389 patent does not require using the same method to form both the EL layer and the planarization layer; and unlike Yamazaki which uses a solution of polymer for the EL and cover layer (EX1005, [0007], [0142]), the '389 patent teaches the use of UV-curable monomer liquid that can potentially address the coffee ring effects and solvent trapping/outgassing known in prior art. EX2031, ¶67 & n.9 (monomer, no solvents); EX2023 & EX2036 (solvent evaporation leading to coffee ring effects), EX2050_2025-10-31_Subramanian, 129:18-130:6 (coffee ring a known problem at the time of the inventions and no evidence of known solutions).

And if Petitioner now argues that manufacturability need not shown, that would be a new argument because the alleged benefits of batch manufacturing “to reduce costs, increase throughput, and increase yield” (Pet. 19) are all benefits particular to manufacturing and not to prototyping.

It is therefore important for Petitioner to demonstrate that Yamazaki's methods were mature enough for a POSITA to start even being concerned with reducing costs, increasing throughputs and increasing yield. And it has not presented any such evidence.

Dr. Subramanian's second deposition confirms the immaturity of Yamazaki's method. The first attempt to combine inkjet printing for both EL and cover layers,

known to Dr. Subramanian, occurred in 2010. EX2050_2025-10-31_Subramanian, 50:22-51:24, 84:11-18, 85:11-86:5, 136:11-137:7. There was also no known attempt to make an OLED using electric field application methods for both EL and cover layers. *Id.* And Dr. Subramanian does not allege that multiple devices were encapsulated and was “not positive” that a barrier layer was deposited over an organic layer, let alone selectively. *Id.* Dr. Subramanian considered himself to be knowledgeable of the literature. *Id.*, 84:20-24.

Petitioner also does not dispute testimony by its own expert (Dr. Antoniadis) that depositing EL and cover layer using inkjet require “different engines” such as different nozzle technology. EX2031, 141:21-143:6. Yet, in Yamazaki, the same print head is used for both EL and cover layer. EX1005, [0179]; EX2050_2025-10-31_Subramanian, 61:7-21; *see also id.*, 110:3-111:12 (not proposing to deviate from Yamazaki’s disclosed steps).

And as noted above, the Reply provides no evidence that Yamazaki’s inkjet printing method could yield a planarization layer over a large area. Nor does it dispute Dr. Antoniadis’s characterization that even today inkjet printing for pixel is still not accurate enough. EX2031, 143:25-144:20; EX2050_2025-10-31_Subramanian, 127:24-128:17 (Subramanian not disputing Antoniadis’s testimony). Thus, as noted in the POR, Yamazaki’s techniques were simply too experimental for a POSITA to even start thinking about costs, throughput or yield

and to extend them to multiple devices. POR 33-38; Reply 17-19. That is, Petitioner has not shown that a POSITA would have extended Yamazaki's method to cover multiple devices on a substrate. POR 33-38; Reply 17-19.

D. Samsung Has Not Shown That Other Claims Are Obvious

Other Grounds I-II claims all require a claimed "planarization layer," "encapsulating a plurality of devices" and "selectively depositing at least one barrier layer over said planarization layer" that is in turn deposited upon a plurality of devices. *See* Claims 35-45. Thus, for reasons stated for claim 34, Petitioner has not shown obviousness for the other Grounds I-II claims either.

In addition, claim 35 requires inkjet printing of the organic layer, which is only disclosed in embodiment 3 (Figure 11). As noted in the POR and above on pp. 7-9, Petitioner has not shown that Yamazaki's inkjet printing method could yield a planarization layer.

Regarding Ground II claims, Petitioner argues that because Dr. Subramanian, an expert, had previously "personally worked on acceleration and having used magnetic masks before," Mr. Humphrey's criticism is without merits. Reply 22-23. But Petitioner does not even assert that Dr. Subramanian ever published those alleged work or that he did the work before the priority date. *Id.* Moreover, "[w]hatever [Dr. Subramanian] did or did not personally realize at the time based on his actual knowledge is irrelevant." *Amazon.com, Inc. v. Barnesandnoble.com, Inc.*,

239 F.3d 1343, 1364 (Fed. Cir. 2001). “The relevant inquiry is what a hypothetical ordinarily skilled artisan,” who had but one year of experience in displays (and not in electromagnetic field), “would have gleaned from the cited references at the time [of the invention].” *Id.*

Thus, Dr. Subramanian’s knowledge does not negate Mr. Humphrey’s explanation of why a POSITA would have been deterred by the complex interactions between a magnetic mask and the electric field and would not have made the combination. Mr. Humphrey’s testimony is consistent with the actual course of development: there has been no examples of a POSITA making the combination in the last quarter of century. POR, 46-48.

III. Grounds III-V Fail

A. Weaver does not disclose a “planarization layer.”

The Reply makes essentially the same argument as in Grounds I-II for why Weaver allegedly discloses a “planarization layer” as construed by the district court. Reply 24-25; EX1032, ¶¶41-42. Weaver says nothing about defects, let alone interrupting defect propagation. EX2050_2025-10-31_Subramanian, 132:13-133:24; *see also* discussions in II.B.1. It is also improper to imply this would be obvious. *Id.*

Moreover, Petitioner fails to show that the layer does not reproduce the underlying topography. As Samsung’s counsel in the district court argued, the

requirement that the planarization layer not reproduce the underlying topography “is about smoothing out the contour of that underlying topography over the OLED device” so as not to “create these sharp edges in the barrier layer which could lead to defects or cracks in the barrier layer.” EX2019, 31:22-32:18, 36:13-38:20 (describing the two functions as “shielding defects from traveling upwards and then providing a substantially smoother surface”).

Weaver’s layers 151, however, follow the contours of the underlying structures and the barrier layers 152 deposited over layers 151 retain the sharp edges that could lead to defects or cracks in the barrier layers. *See* illustration below; POR 55-58; EX2046, ¶¶116-117. As such, the layers 151 do not satisfy the requirement of not reproducing the underlying topography as that phrase is understood by the parties because Weaver’s layers 151 do not “provid[e] a substantially smoother surface” and do not remove the sharp edges of underlying structures, which, according to Samsung’s counsel, are what intended to be covered by the requirement of not reproducing the underlying topography.

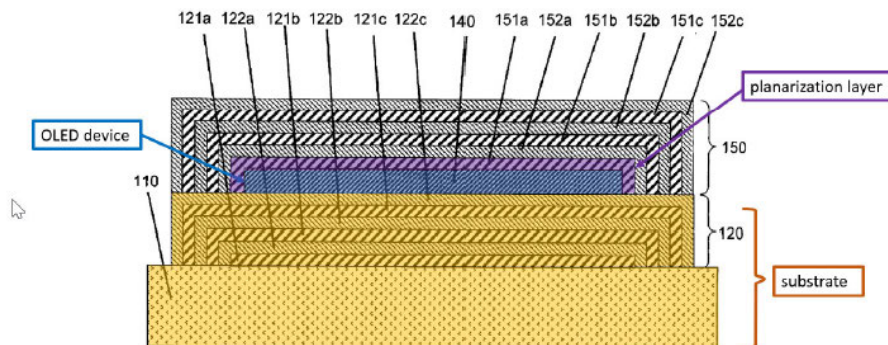


Fig. 6

B. Petitioner Has Not Established that Weaver's Progressive Deposition Was Used to Encapsulate OLED Devices

As a preliminary matter, Pictiva does not agree that Weaver discloses selective deposition of encapsulation structures over OLED devices. *Contra* Reply 26. The statement on POR 73 applies Samsung's assumption that Weaver's Figure 8 disclosed selective deposition and then points out the analytical gap because Petitioner fails to show why a POSITA would have modified Weaver to use Burrows' methods if Weaver already had a selective deposition method. As is clear from the remaining POR, Pictiva disagrees with Petitioner's interpretation of Weaver's disclosures.

For instance, the Reply cites out of context Weaver's disclosure that "[d]eposition of progressively larger cooperative barrier layers can be achieved in a number of ways." Reply 26 (citing Weaver, [0057]). Weaver as a whole makes clear that the description is in reference to structure 120 "over a substrate material" where the deposition sources 221a-c and 222a-c are used to deposit respectively layers 121a-c and 122a-c of structure 120, not structure 150. *Id.*, [0054], [0057]-[0058]; EX2050_2025-10-31_Subramanian, 119:1-120:10. Layers 121a-c and 122a-c are part of structure 120 over a substrate material and not part of structure 150 used to encapsulate an OLED device. *See id.*, 126:10-16; Weaver, Figs. 1b, 2-3, 4a-4g, 5-7, 10; POR 60-62.

That structure 150 “can be arranged in essentially the same fashion as the barrier region 120” does not mean it is made in the same fashion. Otherwise, Weaver would not have limited its descriptions to “formation of planarizing and high-density layers *over a substrate material*.” EX1008, [0054]-[0059]. Weaver does not disclose or suggest that the same description applies also to the formation of structure 150 over OLEDs. *Id.*; *see also* EX2046, ¶¶119-125; POR 61-62.

For instance, Dr. Subramanian acknowledges that Figure 8 depicts a roll-to-roll process. EX2050_2025-10-31_Subramanian, 134:22-135:4. The POR cited EX2100 which summarized the state of the art in 2015 for thin film encapsulation (PML). POR 62-63. According to EX2100, even in 2015, “[f]or the inorganic [barrier] layer the only option in R2R [roll-to-roll] is blanket coating followed by removal material at the end of the process.” EX2100 at 20. The Reply does not rebut this evidence. Reply 25-26.

If the state of the art in 2015, some 13-14 years after the invention, was such that roll-to-roll encapsulation of an OLED (as opposed to substrate) could still only accommodate non-selective deposition of the barrier layer, then a POSITA could have done selective deposition of the barrier layer in 2001-2002. POR 63; EX2046, ¶¶126-130. And to the extent that the roll-to-roll method in Figures 8-9 yielded selective deposition of both the organic and inorganic layers, then that method was limited to encapsulating a substrate material and could not be extended to OLED

encapsulation because even in 2015, roll-to-roll process only accommodated blanket deposition of inorganic materials over OLEDs. This state of the art was consistent with Mr. Humphrey's opinion that no evidence had been provided that Weaver's progressive deposition technique could handle the more demanding sealing of OLED devices. EX2046, ¶125.

Realizing that it had incorrectly applied descriptions specific to the formation of structure 120 to structure 150, the Reply belatedly raises new arguments for why the same procedure would apply to structure 150. Reply 26. The Board should not consider those new arguments raised for the first time in the Reply as Petitioner is modifying its original argument from Weaver expressly disclosing the procedure for structure 150 to why it would have been obvious to apply the procedure to structure 150. The theory comes too late.

Those new arguments also remain insufficient to show obviousness. Specifically, Petitioner argues that because Weaver does not mention an etching step, structure 150 must have been selectively deposited. Reply 26. But no etching is mentioned because Weaver is silent on how structure 150 in Figures 6 and 7 were made in the first instance and Dr. Subramanian agrees that "there is nowhere where it [Weaver] explicitly says that the same exact process steps are used for the layers 120 and layers 150." EX2050_2025-10-31_Subramanian, 126:21-23. As to paragraph [0054] that Dr. Subramanian cites as justifying the extension of Figures

8-9 to structure 150, it is talking about forming layers “over a substrate material,” and not over a device. *Id.*, 127:9-14.

Second, the law does not require Weaver’s specification to describe information which is well known in the art. *See, e.g., Hybritech, Inc. v. Monoclonal Antibodies, Inc.*, 802 F.2d 1367, 1379-80 (Fed. Cir. 1986); EX1009, 8:49-67 (decoupling layer is etched away followed by depositing an inorganic barrier layer that is larger in size); EX1006, [0045] (discussing post deposition patterning of an organic layer, followed by depositing an Al₂O₃ layer and another polymer layer, and etching away the edge of Al₂O₃ inorganic layer). This is particularly the case when Weaver concerns “[a] covered substrate” (not OLED) comprising “(a) a flexible substrate layer; and (b) a plurality of cooperative barrier layers disposed on the substrate layer.” EX1008, Abstract.

Petitioner also argues that non-selective deposition would “effectively doubl[e] the number of necessary process steps.” Reply 26. But the Reply does not explain why this would mean a POSITA would have recognized the process in Figures 8-9 are applied to structure 150 when Petitioner’s own references explicitly teach post-deposition etching as a suitable way to form “[a]n edge-sealed barrier structure” in which “[t]he decoupling layer is sealed by the first barrier layer within the area of barrier material.” *See* EX1009, Abstract; 8:49-67 (decoupling layer is etched away followed by depositing an inorganic barrier layer that is larger in size).

At any rate, this is a new argument not in response to the argument raised in the POR, and should not be considered.

Importantly, these arguments do not overcome the unrebutted evidence that even in 2015, selective deposition of barrier layers over an OLED was not a viable option in roll to roll process. *See* EX2100 at 20, 15. As such, Petitioner has not shown that Weaver's encapsulation layers are selectively deposited.

C. Neither Weaver Nor Palanisamy Disclose Using Inkjet Printing or Screen Printing to Deposit an Organic Planarization Layer (Claim 35)

Indisputably, Weaver does not disclose inkjet printing or screen printing. Petitioner also does not assert that Palanisamy discloses a planarization layer. EX2050_2025-10-31_Subramaninan, 93:16-20, 95:4-13, 98:6-12; POR 64. Thus, neither reference discloses using inkjet printing or screen printing to deposit a planarization layer; and the combination thus necessarily does not disclose the limitations recited in claims 35-36. Weaver in combination with Palanisamy therefore cannot render obvious claim 35-36.

The Reply nevertheless references back to the Petition to argue that “[d]eposition by ink jet was a known technique for depositing such planarization layers” Reply 27 (cite Pet. 77-80). That is incorrect. For example, the Petition cites Cok to argue that “depositing by ink-jet was among the ‘techniques known in the art’ for selectively depositing such planarizing layers.” Pet. 77-78. But just like

the Sturm reference that Petitioner now seeks to discount because it relates to “depositing an EL layer, not an encapsulation layer,” (Reply 27), Cox used inkjet printing for EL layer, not encapsulation layer (EX1021, 10:6-28 (discussing various methods to deposit organic layers of an OLED, including “the layer emitting light,” dye)). Furthermore, Petitioner does not assert that Cox discloses a planarization layer. *See* Pet. 77-80, EX1003, EX1032 *generally*.

Petitioner also argues that the '389 patent indicates inkjet printing was a known technique. Pet. 78-79. While inkjet printing was known, applying it to form a planarization layer was not known as proven by the lack of any reference in the prior art. *See, e.g.*, 2050_2025-10-31_Subramanian, 98:4-100:11 (Sturm uses inkjet printing for EL layer; Duthaler uses inkjet printing for address circuit not OLEDs; not relying on Palanisamy for planarization layer). Moreover, the '389 patent teaches the use of UV-curable liquids for inkjet printing which would have overcome some of the drawbacks (*e.g.*, planarity) associated with prior art methods that used inks mad of polymer resins dissolved in solvents. EX2046, ¶67 & n.9; *see* p. 13 above (discussing why monomer mitigates film forming problems associated with polymer solutions). Additionally, the '389 patent discloses a novel gas nozzle deposition system to direct the deposition of UV-curable acrylate materials dispensed by the dispensing nozzle 708, which can be an inkjet printing dispenser. EX1001, 8:32-58.

The cited Palanisamy reference is also of no help, because as already

explained, it does not have a planarization layer. EX2050_2025-10-31_Subramanina, 98:6-12. Petitioner does not assert that Palanisman's passivation layer qualifies as a planarization layer even under its broad definition.

Petitioner does not explain why a POSITA would have used inkjet printing (or screen printing) to deposit a planarization layer when the prior art does not associate that technique with a planarizing layer. Weaver's statement that its planarizing layer may be "provided using techniques known in the art" means using a technique known to be suitable for depositing deposit planarization layers. Petitioner has not shown that inkjet printing (or screen printing) was such a known technique.

Petitioner also argues that inkjet printing is one of a finite number of known deposition techniques, but it appears to be basing that argument on the number of options recited in Palanisamy. Reply 27. To the extent that Weaver's planarization layer, as Petitioner argues, could be deposited by any known deposition technique—as opposed to techniques known to be suitable for planarization layers, Petitioner does not explain why a POSITA would have limited the deposition techniques to those in Palanisamy, and exclude the ones mentioned by Weaver or the large number of techniques summarized in EX2035. *See* POR 69-70.

Also notably, the Reply does not rebut Mr. Humphrey's explanation on why inkjet printing (or screen printing) would not offer any alleged benefits compared to

Weaver's existing method and may indeed lag in performance in some aspects. POR 64-73; Reply 27-28. Thus, Petitioner has not shown a motivation to modify Weaver to use inkjet printing (or screen printing).

IV. Yamazaki, Weaver, Palanisamy, Ghosh and Burrows Are Not Prior Art

Authenticity Petitioner never objected to EX2006, and the email contained therein therefore “do[es] not require independent corroboration.” *Glob. Health Sols. LLC v. Selner*, 148 F.4th 1363, 1374 (Fed. Cir. 2025). Moreover, the email is referenced in the invention disclosure, which was witnessed by Dr. Antoniadis, a Samsung expert. EX2031, 182:20-185:15.

Definite and Permanent Idea It is legal error to require inventors “to know their invention would work to prove conception.” *Regents of the Univ. of Cal. v. Broad Institute, Inc.*, 136 F.4th 1367, 1378 (Fed. Cir. 2025). Likewise, it is “legal[] err[or] [to] focus[] on . . . statements of uncertainty, without considering whether those statements led to modifications in . . . experiments that substantively changed [the] original idea.” *Id.* Samsung identifies no such modifications here, and accordingly fails to explain how the inventors' expressions of uncertainty, with the use of phrases like “undeveloped” or “bottlenecks,” undermine conception. Indeed, the concrete approaches conceived by the inventors differ from the general experimental plan that the Federal Circuit previously criticized.

Planarization Layer Mr. Humphrey explained that a POSITA would

understand that the inventors were in possession of the concept by reviewing their description of the art. EX2046, ¶154. The '389 Patent's specification need not be contemporaneous because it is used to show the inventors' understanding of certain terms. *Univ. of Pittsburgh of Commonwealth Sys. of Higher Educ. v. Hedrick*, 573 F.3d 1290, 1299 (Fed. Cir. 2009) ("a court may properly weigh evidence that a claimed attribute is merely an obvious property of a greater discovery at issue"). There is also no inconsistency in arguments here because as already explained, neither Yamazaki nor Weaver had planarization layer. Indeed, neither even mentions PMLs. EX1034, 134:13–15, 135:1–4.

Selective Deposition Petitioner misunderstood the email. Dr. Pichler's email responded to Dr. Frischknecht's inquiry on his view of the techniques that Dr. Frischknecht suggested for selectively depositing the organic layers. Dr. Pichler viewed that those methods would work and could be combined with selective sputtering of the inorganic layer. EX2006 at 1. Thus, the email chain showed that the inventors conceived combining the two selective deposition steps.

Reasonably Continuous Diligence Dr. Antoniadis confirmed that between February 2001 and mid-2002, Dr. Frischknecht worked on thin-film-encapsulation and glass-glass encapsulation alternatively. EX2031, 217:25-218:25, 220:23-221:7. The filing of the two applications on inkjet printing in September 2001 also showed diligence between February and August 2001 because it could take more than six

months to file an application after the invention disclosures. EX2031, 23:18-28:21.

The work on inkjet printing of OLEDs is relevant because the '389 inventions can apply to any type of OLEDs. EX1001, 3:56-60. Thus, time devoted to developing techniques to fabricate multiple devices that could then be encapsulated using the selective deposition techniques is part of diligence. *See ATI Techs. ULC v. Iancu*, 920 F.3d 1362, 1372–73 (Fed. Cir. 2019) (an inventor may show diligence by “evaluat[ing] alternatives while developing an invention” or working on features “beyond the reach of the count”). This position is not inconsistent with arguing that EL inkjet printing does not render obvious inkjet printing of planarization layers, because obviousness requires a showing that “each of [the claim’s] elements was, independently, known in the prior art.” *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 418 (2007).

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CERTIFICATE OF WORD COUNT

I hereby certify, pursuant to 37 C.F.R. section 42.24, that the foregoing Patent Owner Sur-Reply contains 5,992 words, excluding the words in the table of contents, table of authorities, exhibit list, this certificate of word count, signature block and certificate of service. The word count is based on the word count of the Microsoft Word program used to prepare the Patent Owner Sur-Reply.

/Hong Zhong/

H. Annita Zhong

CERTIFICATE OF SERVICE

I hereby certify, pursuant to 37 C.F.R. section 42.6, that on November 7, 2025, a complete copy of the foregoing document **PATENT OWNER SUR-REPLY** and **EXHIBITS 2049-2050** were served by electronic mail, as agreed to by the parties, upon the following:

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