

IN THE 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. IPR2024-01223
Patent No. 6,949,389

PETITIONER'S REPLY BRIEF

Second Petition, Asserting Prior Art Under Section 102(b)

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1001	U.S. Patent No. 6,949,389 (“the ’389 patent”)
1002	Certified File History for U.S. Patent No. 6,949,389
1003	Declaration of Vivek Subramanian, Ph.D. (Yamazaki and Weaver grounds)
1004	Declaration of Vivek Subramanian, Ph.D. (Kijima grounds)
1005	U.S. Patent Application Publication No. 2003/0206332 (“Yamazaki”)
1006	U.S. Patent Application Publication No. 2001/0052752 (“Ghosh”)
1007	U.S. Patent Application Publication No. 2003/0011300 (“Palanisamy”)
1008	U.S. Patent Application Publication No. 2002/0140347 (“Weaver”)
1009	U.S. Patent No. 6,866,901 (“Burrows”)
1010	Japanese Published Application No. H09-245964, certified translation (“Kijima”)
1011	Japanese Published Application No. H09-245964, original document
1012	U.S. Patent No. 6,198,217 (“Suzuki”)
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1014	Japanese Published Application No. H10-41069, certified translation (“Fujimori”)
1015	Japanese Published Application No. H10-41069, original document
1016	International Publication No. WO 2001/08242 (“Duthaler”)
1017	U.S. Patent No. 6,660,409 (“Komatsu”)
1018	J. Birnstock et al., <i>Screen-Printed Passive Matrix Displays Based on Light-Emitting Polymers</i> , 78 Appl. Phys. Lett. 3905 (2001) (“Birnstock”)
1019	Complaint, <i>Pictiva Displays Int’l Ltd. v. Samsung Elecs. Co., Ltd., et al.</i> , 2:23-cv-00495-JRG (E.D. Tex. Oct. 19, 2023)
1020	U.S. Patent Application Publication No. US 2003/0062186 (“Boroson”)
1021	U.S. Patent No. 6,770,502 (“Cok”)
1022	U.S. Patent No. 6,214,631 (“Burrows-631”)

Exhibit No.	Description
1023	Jun Hyung Souk, <i>Advances and New Challenges in LCD</i> , International Meeting on Information Display Digest, 24 (2002) (“Souk”)
1024	<i>OLED Fundamentals: Materials, Devices, and Processing of Organic Light-Emitting Diodes</i> (Daniel J. Gaspar & Evgueni Polikarpov eds., 1st ed. 2015) (excerpted) (“Gaspar”)
1025	Takashi Ohta, <i>Next Generation AMLCD Production Technologies for Large Substrate</i> , International Meeting on Information Display Digest, 3 (2001) (“Ohta”)
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1027	Annotated Excerpt of Exhibit 2006
1028	D. Redinger, S. Molesa, S. Yin, R. Farschi, & V. Subramanian, <i>An Ink-Jet-Deposited Passive Component Process for RFID</i> , 51(12) IEEE Transactions on Electron Devices 1978 (Dec. 2004)
1029	D.J. Hayes, M.E. Grove, & D.B. Wallace, et al., <i>Inkjet Printing in the Manufacture of Electronics, Photonics, and Displays</i> , 4809 Nanoscale Optics and Applications 94 (2002)
1030	2002 MRS Spring Meeting Program, <i>available at</i> https://web.archive.org/web/20020802113232/http://www.mrs.org/meetings/spring2002/program/symposia
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1034	F. Santerre, J. P. Dodelet, Y. Sun, A. R. Hlil, A. S. Hay, and M. D'Iorio, <i>OLED Performance and the Use of a Hole Transport Molecule Dissolved in a High Tg Host Polymer</i> , 1999 Int’l Conf. on Digit. Printing Tech., 15 IS&Ts NIP 747-750 (1999)
1035	Deposition Transcript of Kurt Humphrey (IPR2024-01222)
1036	Deposition Transcript of Kurt Humphrey (IPR2024-01223)

I. CLAIM CONSTRUCTION

A. “Planarization Layer”

Pictiva urges the Board to adopt the parties’ agreed construction in the district court of “planarization layer”—namely “a layer of material that planarizes such that the propagation of defects from one layer to another layer can be interrupted and the topography of the underlying layer is not reproduced.” Ex. 2048, 18-19. Petitioner did not propose a construction for this term in the Petition, because it did not believe a construction was necessary to determine that the relied-upon prior art teaches or suggests a “planarization layer.” Regardless, the prior art clearly teaches a “planarization layer” under district court construction for the reasons provided in the Petition and discussed further below. Therefore, Petitioner does not believe an express construction is necessary to resolve the parties’ disputes.

B. “Selectively Depositing”

For “selectively depositing,” Pictiva urges the Board to apply the construction proposed in district court by the defendants—namely “depositing a material only in desired areas, such that no additional processing must be performed for removing unwanted material.” POR, 22-23. Petitioner notes that the district court did not adopt this construction, but instead construed the term to mean “depositing a material in desired areas.” Ex. 2048, 19-20. Again, the prior art teaches this element under any

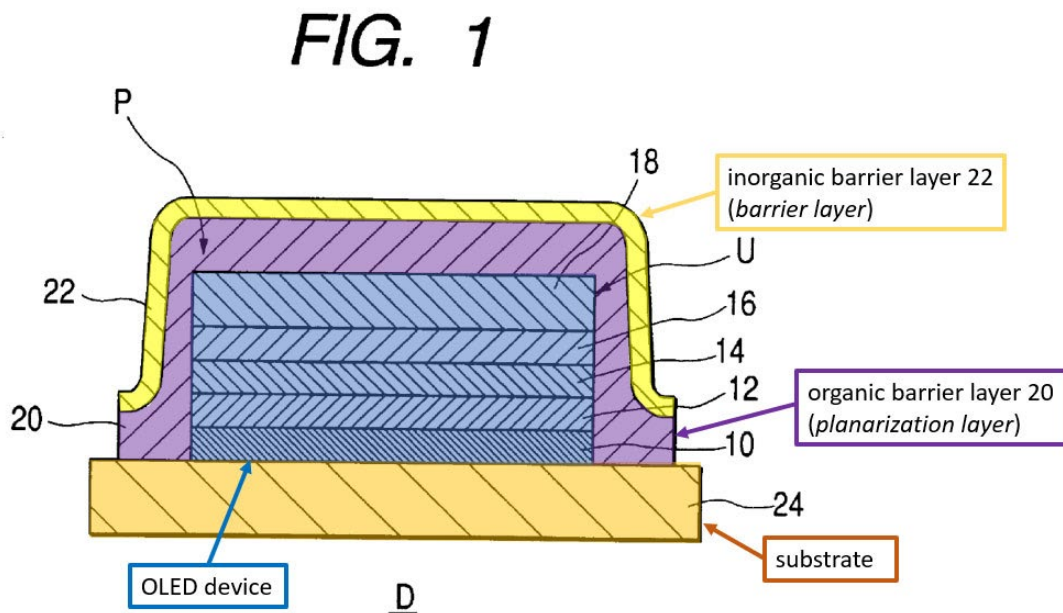
construction, as discussed below. Therefore, Petitioner does not believe an express construction is necessary.

II. THE PRIOR ART SATISFIES THE PLANARIZATION LAYER REQUIREMENT (ALL GROUNDS)

As explained in the Petition, Suzuki teaches a protective double layer barrier including “organic barrier layer 20.” Suzuki, 5:51-54; Pet., 28-37. Suzuki teaches that its organic barrier layer 20 is planarizing – it “cover[s] defects or pinholes” that are “inevitably formed particularly in the uppermost cathode layer 18,” Suzuki, 5:51-54, and “makes a smooth surface on the relatively irregular surface of the cathode 18,” *id.* 5:59-67. A POSITA would have been motivated to combine Suzuki’s organic barrier layer 20 with Kijima’s inorganic sealing film 6, to provide greater protection from environmental effects such as oxygen and moisture as taught by Suzuki. Pet., 32-33. Moreover, Suzuki’s organic barrier layer 20 is a planarization layer under the district court construction, because it smooths out the irregular surface beneath it, thereby not following the underlying topography, and it covers defects, thereby preventing defects from propagating. *See, e.g.*, Suzuki, 5:51-67; Ex.1033 ¶¶11-12.

Pictiva’s argument that “Petitioner does not show the topography of the resulting organic layer” in an illustrated figure is beside the point. POR, 7. The Petition explains why a POSITA would add Suzuki’s barrier layer (which Suzuki both describes and illustrates as planarizing) to Kijima. Pet., 31-32; Kijima Fig. 1.

Suzuki's organic barrier layer 20 would have these same characteristics when applied to Kijima. Ex.1033 ¶14. As noted above, Suzuki's organic barrier layer 20 "makes a smooth surface on the relatively irregular surface of the cathode 18." Suzuki, 5:59-67. Suzuki's Figure 1 depicts this smoothing, with the top of this layer (purple) having visibly rounded corners, unlike the sharp corners of the underlying topology:



In arguing that this figure shows a "*largely* reproduced topology," POR, 19, Pictiva acknowledges that Suzuki's organic barrier layer 20 produces a different topography. During deposition Mr. Humphrey admitted that he was applying a subjective criterion for whether figures in the prior art show enough "rounding" under the proposed construction, but he was unable to articulate when some "rounding" is enough. *See* Ex. 1036, 18:14-23:15. As Dr. Subramanian makes clear,

Suzuki's disclosures inform a POSITA that its organic barrier layer 20 does not reproduce the underlying topography. Ex.1033 ¶¶11-14.

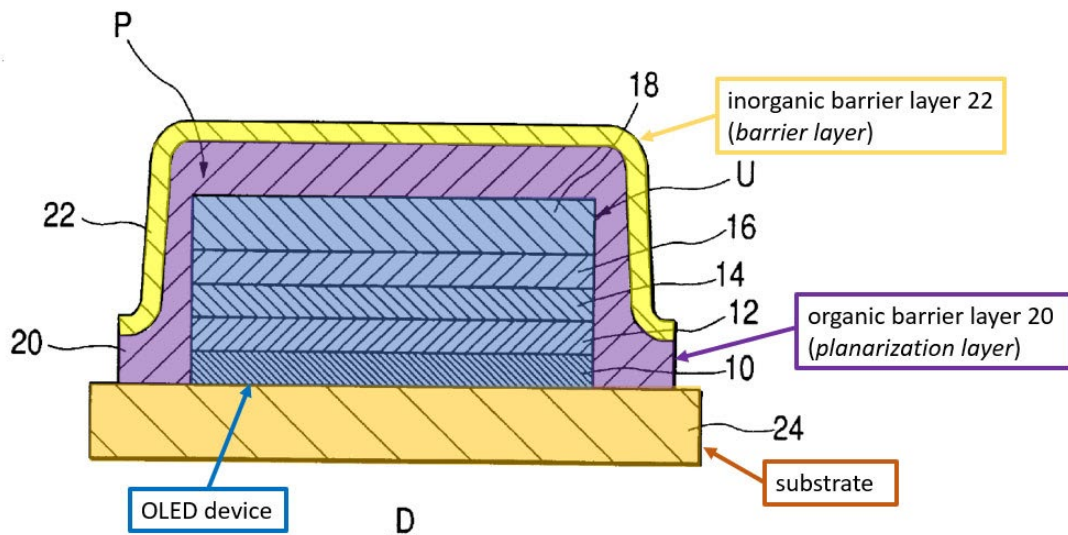
Pictiva argues that the organic layer would follow the topography of Kijima's sealing film 7. POR, 18. But this assertion is based on the illustrated topography of Kijima's layers, rather than that of Suzuki's organic barrier layer 20. *Id.* Pictiva provides no explanation for why it contends a POSITA would deviate from Suzuki's teachings in applying Suzuki's organic barrier layer 20 to Kijima. As Dr. Subramanian explains, they would not. Ex.1033 ¶14.

Pictiva similarly argues that a POSITA would not incorporate the shape of Suzuki's organic layer when applying it to Kijima. POR, 19. This argument is directly counter to Suzuki's teachings. For example, despite Suzuki's express teachings that its barrier layer prevents dark spots, Suzuki, 1:41-52, Mr. Humphrey asserts that Suzuki's organic barrier layer 20 "*in all likelihood* does not reduce dark spots, but *may* introduce additional problems." *Id.* (emphasis added). These unsupported opinions should not be credited. Suzuki's organic barrier layer 20, incorporated in Kijima, would "make[] a smooth surface on the relatively irregular surface of the cathode" as Suzuki discloses. Ex.1033 ¶15; *see also, e.g.,* Suzuki, 5:59-67.

Pictiva argues that "even if the organic layer can cover local defects in Kijima's sealing film 7 and provide a smooth surface," it would still not be a

planarization layer. POR, 20. Pictiva further confusingly asserts that covering such defects would also not be planarizing because such defects should not be considered part of the underlying layer's topography. These arguments again run directly counter to Suzuki's express teachings that the organic barrier layer 20 makes a "smooth surface" "on the relatively irregular surface of the cathode," or in other words does not reproduce the irregular topography of the underlying layer. Suzuki, 5:59-67; Ex.1033 ¶16. Moreover, nothing in the proposed construction purports to differentiate between particular types of defects that may be covered. As Dr. Subramanian explains, Suzuki's organic barrier layer is planarizing under the proposed construction. *Id.*

FIG. 1



Finally, Pictiva is wrong to criticize Dr. Subramanian for not addressing the parties' district court construction in his initial declaration, as the parties had not

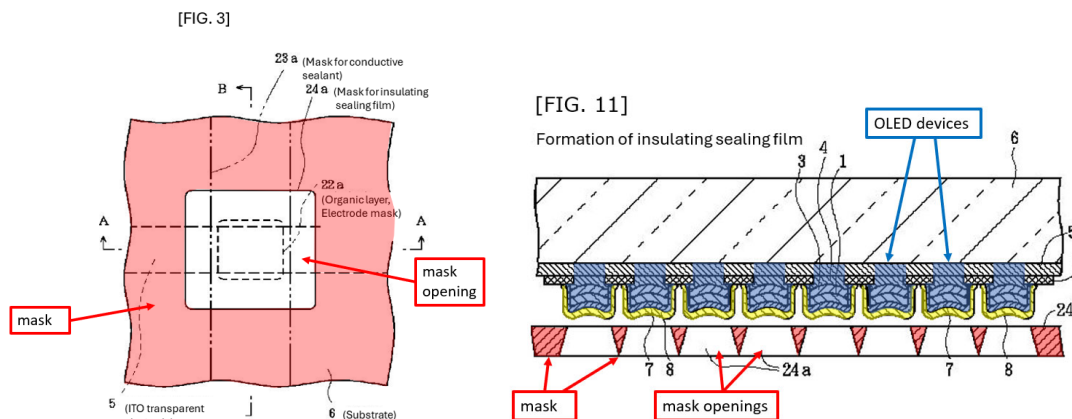
even agreed to this construction until after Dr. Subramanian submitted his testimony.

Ex. 2019, 40:24-35.

III. THE PRIOR SATISFIES THE SELECTIVELY DEPOSITING REQUIREMENTS (GROUNDS I-III)

The Petition showed that Kijima, as modified to include Suzuki's organic barrier layer 20, would entail selectively depositing both the barrier and planarization layers. *See, e.g.,* Pet., 28-37 (element 34[b]), 37-39 (element 34[c]).

Kijima discloses selectively depositing its insulating sealing film 8 (barrier layer), explaining that this film is deposited via a “vacuum deposition device 11” using “mask 24” having “openings 24a,” as shown below. Kijima, [0040]-[0041]; *see* Pet., 28-31, 37-39.



Kijima Figs. 3, 11. Deposition of Kijima's insulating sealing film 8 is restricted to the areas exposed by the mask openings 24a. Thus, Kijima teaches selectively depositing this film using a shadow mask. As explained in the Petition, a POSITA would have been motivated to use the same selective deposition method for

depositing the organic planarization layer (Suzuki's "insulating sealing film 8"), which would be obvious to include in Kijima's device. *See* Pet., 32-33.

Depositing these layers using Kijima's shadow mask plainly entails selectively depositing them under the '389 patent. Ex.1033 ¶17. Deposition through a shadow mask is one of the exemplary selective deposition methods identified in the '389 patent. *See* '389 patent, 7:1-13. Kijima's shadow mask approach constitutes selectively depositing under any construction, because it ensures that the materials are deposited only in desired areas (i.e., only to the areas exposed by the mask openings). Kijima, [0051], Figs. 3, 11; Pet., 37-38. Pictiva's arguments to the contrary are meritless.

A. Selectively Depositing the Planarization Layer (Element 34[b])

For Ground I, Pictiva's sole argument for why this element is not met is that "nothing precludes blanket deposition of the organic layer followed by patterned etching." POR, 22. Pictiva's conjecture that such an approach *might also* have been possible does not refute the Petition's obviousness rationale. *Par Pharmaceutical v. TWI Pharmaceuticals, Inc.*, 773 F. 3d 1186, 1197-98 (Fed. Cir. 2014) ("Our precedent, however, does not require that the motivation be the best option, only that it be a suitable option from which the prior art did not teach away.").

Indeed, Kijima teaches that its sealing film 8 is only deposited "through the openings 24a of the mask 24 to form an insulating film 8 covering the conductive

sealing film 7.” Kijima, [0051]. Kijima does not discuss any subsequent removal step. Nor does it discuss any issue with bleeding or other concerns with unwanted material that might require removal. Ex.1033 ¶18. Thus, Suzuki’s organic barrier layer 20 would be selectively deposited on top of the OLED device in Kijima, in the same way Kijima’s other layers are deposited. Pet., 33-36. This would have been a straightforward and obvious way to apply Suzuki’s organic barrier layer 20 to Kijima. *Id*; Ex.1033 ¶19.

For Grounds II and III, Pictiva improperly seeks to fault the Petition and Dr. Subramanian for not applying a construction that had not been suggested or adopted at the time the Petition was filed. POR, 22-23. In any event, as Dr. Subramanian explains, a POSITA would understand from the teachings of the prior art that the methods described deposit material only where it is wanted. Ex.1033 ¶¶20-21. Ground II explains why a POSITA would have used inkjet printing for selectively depositing the planarization layer. Inkjet printing was a known “suitable printing technology” for selectively depositing as discussed in the ’389 patent. ’389 patent, 4:53-55. Indeed, Pictiva has pointed to a one-sentence reference to inkjet printing as evidence of conception for this element in claim 35. IPR2024-01222, Paper 17, at 8. Nothing in Sturm (or in the ’389 patent’s discussion of inkjetting) suggests the need for a subsequent removal step. Ex.1033 ¶20. Pictiva’s speculation that such a step could be necessary is wrong. Ex.1033 ¶¶20-21.

Similarly, Ground III explains why a POSITA would have used screen printing, another known “suitable printing technology” that is disclosed in the ’389 patent with no mention of any removal step. ’389 patent, 4:53-55. Duthaler similarly does not suggest the need for any removal step. Ex.1033 ¶20.

Additionally, Dr. Subramanian explains the potential for extraneous material being deposited can also be readily accounted for. For example, bleeding under a shadow mask can be controlled through mask design. Ex. 2020, 23:1-11; *see also* Ex.1033 ¶21. Indeed, the ’389 patent makes no mention of the need for any removal step. Ex.1033 ¶20.

Pictiva also points to a paper from 2003 co-authored by Dr. Subramanian involving the use of inkjet printing. POR, 22-23. This article discusses how to prevent a “splash” effect resulting in a formation of a coffee-ring structure using inkjet. Ex. 2023, 2. From this article Pictiva makes broad assertions about the applicability of inkjet printing for depositing encapsulation layers, or the need for a subsequent removal step. POR, 22-23.

There are several flaws in Pictiva’s purported analysis.¹ Ex.1033 ¶¶22-23. The Figure Pictiva references describing a splash effect relates to deposition of a gold

¹ Curiously, Pictiva did not ask Dr. Subramanian any questions about this paper during his deposition.

conductor film, not an organic planarization layer. Moreover, as the paper describes in detail, by controlling the temperature of the substrate and the solvent used, any coffee-ring effect can be eliminated. *See, e.g.*, Ex. 2023 , 4; Ex.1033 ¶¶22-23. Pictiva relies on the unsupported assertions of Mr. Humphrey that the temperatures discussed in Ex. 2023 for removing the coffee-ring effect would not be “suitable” for OLED device encapsulation. POR, 22-23. But as Dr. Subramanian explains, these assertions are wrong. Ex.1033 ¶¶22-23.

B. Selectively Depositing the Barrier Layer (Element 34[c])

Kijima discloses selectively depositing its barrier layer through a shadow mask. *See, e.g.*, Pet., 37-38. Pictiva’s sole argument to the contrary involves a theoretical “bleeding” effect under the mask that would necessitate subsequent removal. POR, 24-25. This argument is dubious at best, as Kijima makes no mention of such removal. It is also at odds with Pictiva’s priority arguments in the parallel IPR, where it argues that conception of element 34[b] (*selectively depositing at least one barrier layer...*) can be shown by an email that briefly references deposition “through a mask”—even though the email provides no detail on how this would work:

34[c]	“Spin-, roll- or whatever-coat, cross-link/cure and then <i>sputter the dielectric barrier through a mask over the OLED area only</i> , i.e. leave the contact pads, scribe lines, etc. free from the barrier and then stick the whole thing in, for example, a plasma asher and ash-off the organic where there is no dielectric barrier film.”
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IPR2024-01222, Paper 17, at 8-9.

Pictiva’s “bleeding effect” argument is also technically flawed, as Dr. Subramanian explains. Ex.1033 ¶¶24-28. Such bleeding effects can be readily accounted for by appropriately designing the mask. Ex. 2020, 23:1-11; *see also* Ex.1033 ¶24.

Moreover, Pictiva bases this argument on a misreading of Fujimori. Fujimori is focused on “fine pattern processing,” and describes that its techniques resulted in improved precision for fine pattern processing. Pictiva takes Fujimori’s general assertion that “a pattern pitch of 2 mm is a suitable example for the mask,” Fujimori, [0035], and based on this statement, Pictiva asserts that there would necessarily be a bleeding effect that could not be accounted for with any 2mm shadow mask. This does not follow. Ex.1033 ¶¶25-26.

Pictiva omits that the same paragraph of Fujimori continues as follows: “and 500 μm is even more favorable.” Fujimori further explains that “[t]he present invention is particularly effective for fine patterning, and 500 μm is an example of a more favorable pitch pattern.” *Id.*, [0036]. Thus, Fujimori does not suggest that there

was an unavoidable bleeding effect for 2mm shadow masks. Nor does Fujimori suggest that any bleeding effect would be substantial enough to require a subsequent removal step. Ex.1033 ¶26. Fujimori merely describes that its techniques were particularly beneficial for even smaller masks for fine patterning. *Id.* As Dr. Subramanian explains, in the 2mm x 2mm mask contemplated by Kijima, bleeding effects could be effectively accounted for and controlled, such that no subsequent removal step would be necessary. *Id.* Indeed, Mr. Humphrey admitted during deposition that the Fujimori’s discussion of problems with known shadow masks only directed to much finer sizes. *See, e.g.*, Ex. 1036, 51:6-52:13; Ex. 1014 at [0008] (noting problems for “a pattern pitch of less than 300 μm ”), [0043] (270 μm electrode width), [0045].

Moreover, even if Fujimori could suggest to a POSITA that Kijima’s shadow mask is insufficient for a particular application, it provides a ready solution—improving the mask. Ex.1033 ¶27. If anything, this would have motivated a POSITA improve Kijima’s shadow mask, instead of turning to a different solution (i.e., a non-selective method followed by a removal step) that is not suggested anywhere in Kijima, Suzuki, or Fujimori. *Id.*

Finally, Pictiva baselessly criticizes Dr. Subramanian’s deposition testimony that inkjet printing would be another viable way to deposit the barrier layer in Kijima. POR, 26. As Dr. Subramanian further explains, a POSITA would have

recognized that this would have been another way to selectively deposit such a barrier layer. Ex.1033 ¶28. For example, Sturm teaches that inkjet can be used for selectively depositing patterned insulators. *See, e.g.*, Sturm, 7:3-12. A POSITA would thus have had a reasonable expectation of success in using inkjet printing for depositing the barrier layer. Ex.1033 ¶28.

IV. IT WOULD HAVE BEEN OBVIOUS TO MODIFY KIJIMA TO ADD A PLANARIZATION LAYER AS TAUGHT BY SUZUKI (ALL GROUNDS)

The Petition explains why a POSITA would have added Suzuki's organic barrier layer 20 to Kijima. Pet., 28-36. In particular, Suzuki explains that when an inorganic barrier layer is applied directly over metal with an irregular surface (such as a cathode), the resulting structure does not work well as a barrier. *See, e.g.*, Suzuki 5:59-67; Fig. 3; Ex. 1004, ¶¶74-78. Suzuki teaches that depositing an organic planarizing layer on which an inorganic barrier layer is then deposited results in improved protection. *Id.* Suzuki explains that the benefits of the organic barrier layer include smoothing out the irregular surface below, and covering defects. *Id.*

These teachings of Suzuki are applicable to Kijima, which teaches an inorganic barrier layer 8 over a metal layer 7. Accordingly, Kijima would be improved by using Suzuki's organic barrier layer 20, deposited on top of Kijima's layer 7 (with Kijima's inorganic barrier layer 8 deposited on top of this organic layer), for the same reasons explained by Suzuki. Providing such multi-layer

encapsulation and was well-known in the art, and a POSITA would have had a reasonable expectation of success in making this modification. Ex. 1004, ¶¶74-78.

In response, Pictiva makes a number of scattershot arguments regarding why a POSITA would allegedly not have modified Kijima to add Suzuki's organic barrier layer 20, including arguments for which the Board has already correctly expressed skepticism in the institution decision. Pictiva further overlooks or seeks to redefine the teachings of the prior art in making these arguments, which are unavailing for the reasons discussed below.

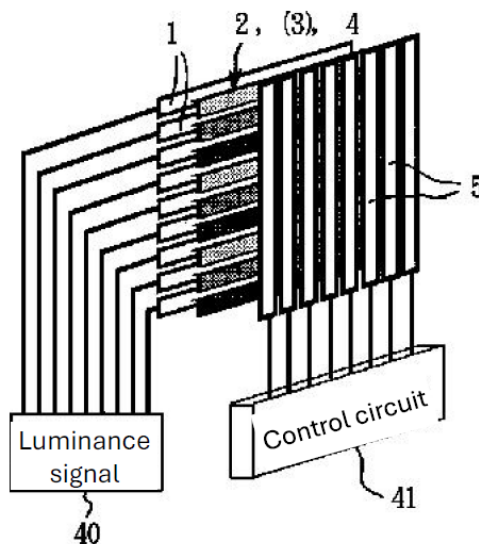
A. Kijima's Conductive Sealing Film Protects Against Radiant Heat During Manufacturing, not Exposure After Manufacturing

First, Pictiva argues that adding Suzuki's organic barrier layer 20 would not create a protective double layer. POR, 27. Pictiva appears to argue that because Kijima's conductive sealing film 7 provides protection to elements of the OLED device underneath, that it cannot be considered part of the device to be encapsulated, and that there is no need for the protection of an additional barrier layer because of the protection conductive sealing film 7 provides. Neither argument avails.

First, as explained in the Petition, conductive film 7 functions together with electrode 1 to serve as a "negative electrode" to drive the OLED. *See, e.g.,* Pet., 25; Ex.1004, ¶63. In particular, conductive film 7 is formed as a stripe, and is what

carries charge to electrode 1. *Id.* Thus, for example, in Figure 24 of Kijima, conductive film 7 would be part of the striped “negative electrode 1:”

[FIG. 24]



Kijima, Fig. 24; *see also id.* [0022]; Ex. 1004, ¶ 63. Based on these teachings of Kijima there is no real dispute that conductive sealing film 7 is part of the device that would be encapsulated in Kijima. Ex.1033 ¶29. Indeed, in criticizing the Petition for allegedly “mischaracterizing” conductive sealing film 7 “as *only* being part of the device, *and not also* being a protective barrier layer” Pictiva acknowledges that conductive film 7 is part of the device itself. POR, 27-28. Thus, known encapsulation techniques such as Suzuki’s would be used to encapsulate the device including conductive film 7. Ex.1033 ¶¶29-32.

Moreover, the Petition readily acknowledges Kijima’s teachings that conductive sealing film 7 provides protection to the elements below it. Pet., 25. But

the protection that conductive sealing film 7 provides is different from the protection encapsulation provides. Ex.1033 ¶¶30-31. Specifically, Kijima teaches that its conductive sealing film 7 serves to prevent “degradation of the organic layer due to radiant heat during vapor deposition of the insulating sealing film 8.” Pet., 25. Indeed, Kijima discloses that “the conductive sealing film is made of a material with good thermal conductivity such as a metal, efficient dissipation of the radiant heat can be expected,” thereby demonstrating the “degradation of the organic layer due to radiant heat ... is prevented.” Kijima, [0056]-[0057]. Ex.1033 ¶¶30-31.

Pictiva points to Kijima’s discussion of conductive sealing film 7 “protecting the underlying layer and electrode and preventing oxidation of the electrode 1,” and argues that this film provides sufficient protection. POR, 30-31. But Kijima makes clear that, in contrast to the protection an encapsulating layer provides, conductive sealing film 7 does not provide adequate protection from exposure after manufacturing. Ex.1033 ¶¶30-31.

In particular, Kijima’s Comparative Example 3 explains that after depositing the conductive sealing film 7, vacuum conditions were temporarily removed, and then returned before depositing insulating sealing film 8. Kijima, [0084]. Kijima explains that the EL element produced in this manner showed “adverse effects of exposing the element to the atmosphere,” including an “increase in dark spots.” Kijima, [0086]-[0087]. In other words, conductive sealing film 7 alone, even

deposited in vacuum conditions, did not protect the underlying EL device from subsequent exposure. Ex.1033 ¶¶30-31.

A POSITA would have thus understood conductive sealing film 7 does not provide sufficient protection. Ex.1033 ¶¶30-32. Indeed, for example, '389 patent never mentions radiant heat generated during manufacturing. Ex.1033 ¶32. And the primary protection provided by conductive sealing film 7 provides is against radiant heat during the deposition of insulating sealing film 8. *Id.* Thus, encapsulation layers like Suzuki's organic barrier layer 20 would provide necessary protections to the underlying EL element. Ex.1033 ¶¶30-32.

B. A POSITA Would Have Recognized the Additional Protection Provided by Suzuki's Organic Barrier Layer

Pictiva relatedly argues that adding Suzuki's organic barrier layer 20 to Kijima results in an unnecessary "triple-layer structure." POR, 31-36. Pictiva's argument misses the point. Suzuki teaches that its dual-layer *encapsulation* provides improved protection from exposure to atmosphere. The Petition thus proposes the creation of a dual-layer *encapsulation* by adding Suzuki's organic barrier layer 20. Regardless of whether the resulting structure is characterized as "dual-layer" or "triple-layer," a POSITA would have recognized the benefits of that encapsulation. Ex.1033 ¶¶33-34.

Indeed, as described above, a POSITA would have understood that Suzuki's organic barrier layer 20 would have provided additional, beneficial protection.

Suzuki specifically describes that its encapsulation prevents growth of dark spots. *Id.*, 1:41-52. And as Kijima teaches, Kijima's conductive sealing film 7 does not protect from exposure to atmospheric conditions that lead to dark spots. Kijima, [0086]-[0087]. Thus, a POSITA would have recognized the benefits of using a multi-layer encapsulation for the OLED device as Suzuki teaches. Ex.1033 ¶¶33-34.

Pictiva also argues that Suzuki's organic barrier layer 20 is unnecessary because there would be no defects in the surface of Kijima's conductive sealing layer 7. POR, 37-42. Pictiva seeks to dismiss the rationale provided in the Petition by arguing that Kijima makes no mention of defects or surface irregularities that Suzuki's organic barrier layer 20 would cover. *Id.* But the Petition does not rely upon Kijima for the motivation to add Suzuki's organic barrier layer 20. As Dr. Subramanian has explained, a POSITA would have readily understood that Suzuki's organic barrier layer 20 would cover defects in Kijima. Ex.1033 ¶35.

Pictiva also points to Dr. Subramanian's testimony that 1-micron thick layer of gold would not be likely to have specifically pinhole defects. Ex. 2021, 61:7-22. However, Kijima does not include any planarization layer that would smooth defects in its cathode. Ex.1033 ¶36. In contrast, Suzuki teaches that its organic barrier layer 20 provides such smoothing, and that defects are "inevitably" formed, "*particularly* in the uppermost cathode layer 18, and an inorganic barrier layer 22." Suzuki, 5:51-54; Pet., 32-33; Ex.1033 ¶36.

Additionally, Kijima does not require that its conductive sealing layer 7 be made of gold or even made of metal. Kijima, [0057]. Moreover, Dr. Subramanian explained that comparable defects in the surface of a deposited gold layer, including buckling, would be covered by Suzuki's organic barrier layer 20. Ex. 2021, 61:25-65:25; *see also, e.g.*, Ex.1033 ¶36.

C. Pictiva Misunderstands the Results of Kijima's Experiments

Pictiva next repeats its argument that Kijima provides sufficient protection. POR, 41-47. This argument fails for the same reasons the Board correctly identified in the institution decision. DI, 13-14. Specifically, Kijima describes that its approach produced devices with "good stability" that had no observable dark spots "for one month after production." Ex. 1010, ¶¶ 54, 58, 64, 68, 72. The OSRAM product cited by Pictiva, for example, has a lifespan of 10,000 hours at 25 degrees Celsius. Ex. 2039, 1. Kijima's experiments proceeded for only a fraction of that duration, and is thus silent as to the efficacy of the encapsulation during the full lifespan of an OLED device. The addition of Suzuki's organic barrier layer 20 would have provided improved dark spot reduction over Kijima's approach alone. *See, e.g.*, Pet., 33-34; Ex.1004 ¶¶74-78; *see also* Ex.1033 ¶37.

Pictiva also repeats its argument from its preliminary response that the Petition does not show that Suzuki would be more effective than Kijima's method alone. As the Board correctly explained, "it is unpersuasive to argue that Kijima's

sealing films are more effective than Suzuki's at preventing dark spots because we understand that Petitioner proposes augmenting Kijima's vacuum-deposited sealing films by adding Suzuki's organic sealing layer." DI, 14. The Petition proposes adding Suzuki's organic barrier layer 20 and describes the benefits that would be obtained through the addition of that layer. *See, e.g.*, Pet., 32-33. Pictiva seeks to dismiss these benefits taught by Suzuki by repeating its same arguments that Kijima's conductive sealing film 7 would have no surface defects, or that the prior art does not specifically describe a "triple-layer" encapsulation, which fail for the same reasons noted above.

Additionally, Pictiva's contrasting of the experimental findings of Suzuki and Kijima is misplaced. Suzuki and Kijima have significant variance with respect to the materials used and structures formed. Ex.1033 ¶38. Additionally, the experimental conditions in each reference vary significantly, both with respect to temperature and humidity. *Id.* There is thus minimal, if any, utility in attempting to compare these fundamentally different experimental processes, with their separate focuses and objectives. Indeed, Kijima's focus was on oxidation by radiant heat generated during the manufacturing process. *Id.* Suzuki, in contrast, was focused specifically on the benefits of encapsulation structures. *See, e.g.*, Suzuki Fig. 3; Ex.1033 ¶38. Suzuki's results are clear that its multilayer encapsulation structure of organic and inorganic

barrier layer is superior to an encapsulation structure consisting of a single inorganic barrier layer, as in Kijima. Ex.1033 ¶38.

D. A POSITA Would Have Added Suzuki's Organic Barrier Layer to Kijima

Finally, Pictiva argues that Kijima and the knowledge of a POSITA would have discouraged adding Suzuki's organic layer to Kijima. POR, 47-54. Pictiva largely repeats its arguments that Kijima provides sufficient protection, which fail for the same reasons noted above. Pictiva additionally argues that a POSITA would have avoided additional layers wherever possible. POR, 47-48. This overlooks the specific benefits taught by Suzuki noted in the Petition and above, and fails for the same reasons the Board noted. DI, 13-14. As Dr. Subramanian explains, it was well-known to deposit layers such as Suzuki's organic barrier layer 20, and would have been well within the skill of a POSITA. Ex.1033 ¶39.

Pictiva also repeats its argument that the Petition's modification goes against Kijima's teachings regarding radiant heat dissipation. POR, 50-54. However, as the Board correctly found in the institution decision, the Petition's theory keeps Kijima's conductive sealing film 7, and deposits Suzuki's organic barrier layer 20 *on top of* Kijima's conductive sealing film 7. DI, 15-16; *see also* Pet., 33-35. Thus, conductive sealing film 7 would still dissipate radiant heat consistent with Kijima's disclosures. Ex.1033 ¶40. Pictiva appears to argue that the presence of organic barrier layer 20 when depositing the insulating sealing film 8 could lead to additional issues with

heat dissipation. POR, 52. But Pictiva provides no analysis or explanation of what issues it believes this might cause. As Dr. Subramanian explains, no such issues exist. Ex.1033 ¶40. Indeed, for example, Example 4 of Suzuki describes vacuum depositing its inorganic barrier layer on the organic barrier layer, resulting in a device “having the protective layer of the invention was remarkably improved in storage stability.” Suzuki, 9:13-23. And even if this speculative concern were credited, it could be controlled for, Ex.1033 ¶40, and would not diminish the encapsulation benefits of Suzuki’s barrier layer. *See, e.g., Winner Int’l Royalty Corp. v. Wang*, 202 F.3d 1340, 1349 n.8 (Fed. Cir. 2000) (“that the motivating benefit comes at the expense of another benefit, however, should not nullify its use as a basis to modify the disclosure of one reference with the teachings of another”).

V. CLAIM 35 IS OBVIOUS OVER KIJIMA IN VIEW OF SUZUKI AND STURM

A POSITA would have recognized that there were other known methods for selectively depositing encapsulation layers, each with their own benefits and considerations. Pet., 42. One such known method was deposition by inkjet. *Id.* Indeed, the ’389 patent acknowledges that “many manners” including inkjet printing could be used for depositing its planarization layer. ’389 patent, 4:48-55; *see also id.* 7:3-5. The ’389 patent presumes that a POSITA would know how to employ inkjet technology, because it provides no detail on how to use inkjet. Pet., 42-43. Prior art references, including Sturm and Duthaler demonstrate that deposition by

inkjet was among the known method. *Id.* The Petition further explains the benefits of using inkjet deposition, including increased precision, minimized risk of contamination, and material efficiency. Pet., 43-44; Ex.1033 ¶¶41-42.

Pictiva argues that Sturm is “not analogous art,” because it does not discuss encapsulation layers specifically. POR, 54. But as the Board found, the Petition relies on Sturm “only for teaching ink-jet depositing,” rather than specific encapsulation layers. DI, 18-19. The Petition further explains why it would have been obvious to use Sturm’s inkjet deposition method. Pet., 42-45. That Sturm does not disclose OLED encapsulation specifically does not address the arguments presented in the Petition as to why it would have been obvious to use Sturm’s inkjet deposition. Ex.1033 ¶43.

Pictiva also suggests that deposition of OLED layers is significantly different than depositing encapsulation layers, but does not explain any particular difficulties it believes would prevent depositing encapsulation layers via inkjet, other than that the size of the encapsulation may be larger or thicker than EL layers Sturm describes. POR, 54-57. But the Petition relies on Sturm’s inkjet deposition for depositing the encapsulation layers on individual OLED devices (i.e., pixels), not a larger area as Pictiva suggests. Pet., 41-45; Ex.1033 ¶44.

Similarly, as Dr. Subramanian explains, it was known that inkjet could be used to deposit thicker layers in a single pass, for example by tuning the ink to increase

viscosity. Ex.1033 ¶45. Even at Sturm’s stated thickness, it would have been well within the skill of a POSITA to make additional passes to generate an appropriately thick layer. *Id.* Pictiva again points to Ex. 2023 to suggest Sturm’s inkjet method would not be appropriate for depositing encapsulation layers, but Ex. 2023’s discussion is inapposite. *Id.* Additionally, as Dr. Subramanian explains, Ex. 2023 shows that the coffee-ring effect could be suppressed. *Id.* Moreover, contrary to Mr. Humphrey’s conclusory assertions, the temperatures discussed in Ex. 2023 would be suitable for depositing OLED layers. *Id.*

Pictiva additionally argues that there would be problems using inkjet printing to deposit the other layers of Kijima. POR, 62. Pictiva argues that “inkjet could not be used to form the gold film required to perform the sealing function” *id.*, pointing to Dr. Subramanian’s 2003 paper. But as Dr. Subramanian explains, there were known OLED materials that could be deposited at the temperatures discussed in the 2003 paper. Ex.1033 ¶¶46-47. Pictiva’s additional conclusory arguments, including that there were challenges with forming nanoparticle solutions that could not be overcome, and that inkjet printing could not produce a dense barrier layer are similarly unsupported. *Id.*

Pictiva further argues that Kijima’s teachings regarding forming films under vacuum conditions would dissuade the use of inkjet. POR, 64-65. But as Dr. Subramanian explained during deposition, inkjet printing is routinely done under

nitrogen. Ex. 2021, 106:8-107:7. Indeed, it has been standard “for decades in the OLED business,” to have an evaporator connected to a glove box, which is under nitrogen, with an inkjet printer inside the glove box, so that there is “no exposure to air in the process.” *Id.* A POSITA would have been well aware of this standard approach to inkjet printing, which is fully consistent with Kijima’s teachings to avoid exposing the device to atmosphere. Ex.1033 ¶48.

Finally, Pictiva points to a 2003 paper co-authored by Dr. Subramanian to argue that Kijima’s conductive sealing film 7 could not be deposited by inkjet, because before the work in this paper there were no gold nanoparticles that could be sintered at temperatures suitable for OLEDs. POR, 62. But as Dr. Subramanian explains, this paper described work done (and published) before the priority date, and shows that a POSITA would have understood that Kijima’s conductive sealing film 7 would readily be applied by inkjet. Ex.1033 ¶¶49-51. Further, claim 35 would be satisfied regardless of whether inkjet is used for depositing Kijima’s conductive sealing film. *Id.* ¶52.

VI. CLAIM 36 IS OBVIOUS OVER KIJIMA IN VIEW OF SUZUKI AND DUTHALER

Pictiva erroneously suggests that the Petition does not explain why a POSITA would have used screen printing as taught by Duthaler to selectively deposit Suzuki’s organic barrier layer. As explained in the Petition, benefits taught by Duthaler for its screen-printing technique include low-cost and high throughput.

Pet., 48-49; Duthaler, 14:13-23. A POSITA would have further recognized that Duthaler's screen-printing method had the ability to deposit relatively thick organic layers. Ex.1004, ¶115.

Pictiva argues that there is "no evidence" that screen printing could be done in vacuum conditions. Not so. As Dr. Subramanian explains, "of course screen printing is routinely performed under nitrogen," as with inkjet. Ex. 2021, 178:9-18; Ex.1033 ¶53. And even if there were some trade-off in Duthaler's approach, the Petition explains why Duthaler's approach would nevertheless be a suitable approach for depositing the planarization layer. *Par Pharmaceutical*, 773 F. 3d at 1197-98.

VII. CLAIMS 41-46 ARE OBVIOUS OVER KIJIMA IN VIEW OF SUZUKI AND FUJIMORI

For this ground, Pictiva first repeats its same arguments as for Ground 1, which fail for same reasons explained above. Pictiva next argues that a POSITA would not have used Fujimori's shadow mask to deposit encapsulation layers because Fujimori uses its shadow mask for depositing EL layers. This is not persuasive. Kijima teaches the use of a shadow mask to selectively deposit its layers. And Fujimori teaches an improved method for using shadow masks. A POSITA would have been motivated to use Fujimori's shadow masking technique, including to improve accuracy and enable smaller pixel size. Pet., 54; Ex.1033 ¶54.

Finally Pictiva argues that the limitations of claim 43 are not met, because the mask is not in contact with the substrate, but instead on an SiO₂ film. But the SiO₂ film is the topmost layer on the substrate, and the shadow mask is in direct contact with it. The shadow mask is thus in contact with the substrate through the SiO₂ film, as opposed, to example, being separated by an air gap. Ex.1033 ¶55.

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CERTIFICATION UNDER 37 C.F.R. § 42.24(D)

I certify that the foregoing complies with the type-volume limitation of 37 C.F.R. § 42.24 and contains 5,587 words based on the word count indicated by the word-processing system used to prepare the paper, and excluding those portions exempted by § 42.24(a).

Date: October 9, 2025

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CERTIFICATE OF SERVICE

Pursuant to 37 C.F.R. § 42.6, I hereby certify that the foregoing Petitioner's Reply was served by electronic mail on the following counsel of record for patent owner:

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