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. IPR2024-01093
Patent No. 8,723,164

PATENT OWNER SUR-REPLY

Mail Stop "PATENT BOARD"
Patent Trial and Appeal Board
U.S. Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450

TABLE OF CONTENTS

Page

I. Introduction 1

II. Claim Construction 2

A. The Intrinsic Evidence Clearly Distinguishes Matrix Materials From Materials Embedded in Matrix Materials, Such As Dopants. 2

B. The District Court and Petitioner's New Claim Construction Supports Patent Owner's Position That Matrix Materials Do Not Include Dopants. 7

C. The Extrinsic Evidence Is Consistent With the Intrinsic Record. 10

III. Ground 1: Choulis Does Not Anticipate or Render Obvious Claims 1-8 and 10-16. 12

A. Choulis's TPD and PBD Are Dopants, Which are Not Encompassed by the Term "Matrix Material." 12

B. Choulis Does Not Anticipate or Render Obvious Claims 2, 4 and 15-16 14

C. Choulis Does Not Anticipate or Render Obvious Claim 10 15

D. Choulis Does Not Anticipate or Render Obvious Claims 13 and 14 15

IV. Ground 2: Choulis and Yong Do Not Render Obvious Claim 9. 16

V. Ground 3: Sugiura Does Not Anticipate or Render Obvious Claims 1, 3, 5-8, and 10-13. 20

VI. Ground 4: Thompson Does Not Anticipate or Render Obvious Claims 15-16 26

TABLE OF AUTHORITIES

Page(s)

Cases

In re Abbott Diabetes Care Inc.,
696 F.3d 1142 (Fed. Cir. 2012) 3

Groove Digital Inc. v. United Bank,
825 F. App'x 852 (Fed. Cir. 2020).....4

Network, LLC v. Centraal Corp.,
242 F.3d 1347 (Fed. Cir. 2001) 6

Phillips v. AWH Corp.,
415 F.3d 1303 (Fed. Cir. 2005) 2, 3, 6

Rembrandt Wireless Tech., LP v. Samsung Elecs. Co. Ltd.,
853 F.3d 1370 1379-80 (Fed. Cir. 2017).....19

TIP Systems, LLC v. Phillips & Brooks/Gladwin, Inc.,
529 F.3d 1364 (Fed. Cir. 2008) 4

*Trustees of Columbia University in City of New York
v. Symantec Corp*., 811 F.3d 1359 (Fed. Cir. 2016).....3

Vas-Cath, Inc. v. Mahurkar,
935 F.2d 1555 (Fed. Cir. 1991) 23

EXHIBIT LIST

Exhibit No.	Document Description
EX2001	Declaration of Dr. Marc Sims
EX2002	Dictionary definition of "matrix" from online version for A Dictionary of Chemistry (6th ed.), Oxford University Press (2008), available from https://www.oxfordreference.com/display/10.1093/acref/9780199204632.001.0001/acref-9780199204632-e-2628?rskey=JZee15&result=2921 (last access Oct. 25, 2024)
EX2003	Dictionary definition of "matrix" from Merriam-Webster's Collegiate Dictionary (11th ed.), Merriam-Webster, Incorporated (2007)
EX2004	Dictionary definition of "matrix" from Cambridge Advanced Learner's Dictionary, Cambridge University Press (2003)
EX2005	Samsung Proposed Claim Constructions for the Terms and Phrases Identified for Construction per Local Patent Rule 4-2 in *Pictiva Displays Int'l Ltd. v. Samsung Electronics Co. Ltd., et al.*, Case No. 2:23-cv-000495 (E.D. Tex. Oct. 22, 2024)
EX2006	Harald Gross et al., *High Power Efficiencies at Record Lifetimes: NOVALED's PIN-OLEDs*, FPD Yokohama 2005 (obtained from IPR2024-01095)
EX2007	B.C. Krummacher et al., *General method to evaluate substrate surface modification techniques for light extraction enhancement of organic light emitting diodes*, 100 J. Appl. Phys. 054702 (2006)
EX2008	Chelsea M. Hess et al., *Dielectric Dependence of Single-Molecule Photoluminescence Intermittency: Nile Red in Poly(vinylidene fluoride)*, 118 J. Phys. Chem. 8905-8913 (2014)
EX2009	E. H. Martin & J. Hirsch, *Charge Transport and Carrier Mobilities in Insulating Polymers*, 4 J. Non-Crystalline Solids 133-137 (1970)
EX2010	Ying Wang et al., *Hole mobility and conductance of iridium complex doped NPB emission layers for organic light-emitting diodes*, 244 Synthetic Metals 61-65 (2018)

Exhibit No.	Document Description
EX2011	WO2002/074015 to Thompson & Forrest ("Thompson WO")
EX2012	Dictionary definition of "matrix" from A Dictionary of Chemistry (5th ed.), Oxford University Press (2004)
EX2013	Dictionary definition of "matrix" from Chambers Dictionary of Science and Technology, Chambers (2007)
EX2014	Federal Court Management Statistics for U.S. District Courts, available from https://www.uscourts.gov/statistics/table/na/federal-courtmanagement-statistics/2024/06/30-1
EX2015	Samsung Invalidity Contentions in *Pictiva Displays Int'l Ltd. v. Samsung Electronics Co. Ltd., et al.*, Case No. 2:23-cv-000495 (E.D. Tex. Jun. 11, 2024)
EX2016	Declaration of Dr. E. Fred Schubert in Pictiva Displays Int'l Ltd. v. Samsung Electronics Co. Ltd., et al., Case No. 2:23-cv-000495 (E.D. Tex. Nov. 12, 2024) on behalf of real parties-in-interest
EX2017	2024-12-09 Email from Samsung to Pictiva re "IPR2024-01095 – Stipulation"
EX2018	Deposition Transcript of Dr. Schubert with Ex. 1 of the deposition (Schubert Declaration) and Ex. 9 of the deposition (Sugiura reference)
EX2019	[UNDER SEAL] Declaration of Dr. Marc Sims (submitted with Patent Owner Response)
EX2020	Deposition Transcript of Dr. Russell J. Holmes, April 18, 2025
EX2021	Yuanmin Wang *et al*., *Green to white to blue OLEDs by using PBD as a chromaticity-tuning layer*, Science Direct, Displays 25 (2004) 237–239
EX2022	Y.B. Yoon *et al., Electroluminescence Mechanism for the Efficiency Enhancement and the Color Stabilization of Yellow Organic Light-Emitting Devices with a Mixed Layer*, Mol. Cryst. Liq. Cryst., Vol. 459, pp. 3/[283]–10/[290], 2006
EX2023	Venla M. Manninen *et. al., Synthesis and characterization of tris-(5-amino-8-hydroxyquinoline)aluminum complexes and their use as anode buffer layers in inverted organic solar cells*, J. Mater. Chem., 2012, 22, 22971

Exhibit No.	Document Description
EX2024	US7,911,129 issued to Hofmann, Mar. 22, 2011
EX2025	Deposition Transcript of Barry P. Rand, Ph.D., Apr. 3, 2025
EX2026	Gufeng He *et al*., *Very high-efficiency and low voltage phosphorescent organic light-emitting diodes based on a p-i-n junction*, J. Appl. Phys. 95, 5773-5777 (2004)
EX2027	US6,303,238 issued to Thompson, Oct. 16, 2001
EX2028	Joint Claim Construction Chart, Ex. 1, Doc #161-1, Case 2:23-cv-00495
EX2029	Forrest *et al*., US Publication No. 2008/0116536 A1, published May 22, 2008
EX2030	US9,403,849 issued to Stoessel, Aug. 2, 2016
EX2031	[UNDER SEAL] Excerpts from Expert Report of Dr. Ioannis Kymissis Regarding Validity of U.S. Patent Nos. 8,558,223 and 8,723,164
EX2032	District Court Claim Construction Order
EX2033	2025-09-12 Holmes Deposition Transcript
EX2100	US10,333,070 issued to Thompson, Jun. 25, 2019
EX2101	US8,679,647 issued to Pflumm, Mar. 25, 2014
EX2102	US10,586,926 issued to Hartmann, Mar. 10, 2020
EX2103	US8,119,037 issued to Zeika, Feb. 21, 2012
EX2104	US8,212,245 issued to Birnstock, Jul. 3, 2012
EX2105	2025-09-12 Holmes Deposition Exhibit 2105
EX2106	2025-09-12 Holmes Deposition Exhibit 2106
EX2107	2025-09-12 Holmes Deposition Exhibit 2107
EX2108	2025-09-12 Holmes Deposition Exhibit 2108
EX2109	2025-09-12 Holmes Deposition Exhibit 2109

I. Introduction

Petitioner's unpatentability challenges fail because each ground relies on one or more dopants to satisfy the "matrix material" limitations. Petitioner's argument that dopants and dispersed agglomerations can be matrix materials contradicts the intrinsic evidence. *See* Section II.A.

Petitioner also attempts to improperly shift the burden of proof by contending that Patent Owner has not shown that certain prior art dopants are ***not*** matrix material. Yet, it is ***Petitioner's*** burden to show that what the prior art expressly characterizes as dopants ***are*** in fact matrix materials. *See* Sections III, V, VI.

Petitioner has also not established that dopants and dispersed agglomerations are "***part of the same matrix***" in order to qualify as matrix materials under Samsung's claim construction that the district court adopts. EX2032, 32, 50; Reply, 4; EX1044, ¶7. That construction precludes "materials embedded within the matrix" (DI, 29), such as dopants or dispersed agglomerations, from being matrix materials because embedded materials are guests to the matrix and not part of the matrix. *See* Section II.B.

Petitioner also fails to show unpatentability for dependent claims. For example, a POSITA would not have built an emitter gradient as required by claim 9 in Choulis because, unlike Yong, Choulis had no charge carrier gradient. Nor would a POSITA have evaporated PVK. *See* Section IV.

II. Claim Construction

A. The Intrinsic Evidence Clearly Distinguishes Matrix Materials From Materials Embedded in Matrix Materials, Such As Dopants.

Despite the specification being "the single best guide to the meaning of a disputed term,"[1] Petitioner's Reply ("Reply") fails to address the express teachings in the specification distinguishing a matrix material from a dopant, as identified in the Patent Owner Response ("POR"). *See e.g.*, EX1001, FIG. 2 (depicting "first matrix material 30N," "second matrix material 30B," "third matrix material 30A," and separately "emitter material 30E"), 6:16-37; 4:10-12 (noting that there are "concentrations of the emitter material and the matrix materials"); 4:44-49 (comparing the LUMO and HOMO energy levels of "the emitter material" with those of "the first, second, and third matrix material"); 4:15-16; 6:13-15 ("The emission layer 30 can have a first, a second, and a third matrix material and be doped with an emitter material"); 7:13-19 (twice describing the evaporation of "matrix materials and/or doping substances"); 8:56-64 (describing "doping … an electron transport material" into "an NBP matrix."). *See* EX2033 (Holmes), 75:15-16 (testifying that "when the term 'doping' is used," it refers to a "dopant."). Even Dr.

[1] *Phillips v. AWH Corp.*, 415 F.3d 1303, 1320-21 (Fed. Cir. 2005)

Holmes acknowledged that "in the '164, there's a distinction between the matrix materials used and the emitter material." EX2020, 298:18-22.

The Reply argues that the distinction between a matrix material and a dopant is not definitional (Reply, 4), but Pictiva is not arguing that a matrix material must be present above a certain concentration. Instead, Pictiva submits that the prior art expressly discloses certain materials being used as dopants, while the '164 patent ***defines at least by implication*** matrix materials to exclude dopants by consistently contrasting a "matrix material" with a dopant, such as an emitter. POR, 10-11. *See Phillips*, 415 F.3d at 1320-21 ("[T]he specification acts as a dictionary … when it defines terms by implication."). Federal Circuit precedent does not require explicit redefinition or disavowal. *See Trustees of Columbia University in City of New York v. Symantec Corp*., 811 F.3d 1359, 1364 (Fed. Cir. 2016) (holding that the specification should be consulted to determine a term's meaning because "a claim term may be clearly redefined without an explicit statement of redefinition" and "[e]ven when guidance is not provided in explicit definitional format, ***the specification may define claim terms by implication*** such that the meaning may be found in or ascertained by a reading of the patent documents."); *see also In re Abbott Diabetes Care Inc*., 696 F.3d 1142, 1148–50 (Fed. Cir. 2012) ("electrochemical sensor" does not include a sensor with external cables and wires where the patent "repeatedly, consistently, and exclusively" described an electrochemical sensor

without external cables or wires); *Groove Digital Inc. v. United Bank*, 825 F. App'x 852, 856 (Fed. Cir. 2020) (construction of "applet" requiring geotargeting was not error where the patent "repeatedly, consistently, and exclusively" described applets as being geotargeted).

Petitioner's reliance on the embodiment at col. 8:56-65 is misplaced because that embodiment does not characterize the "dop[ant]" BCP as a matrix material or even use the term "matrix material" at all. *See* EX1001, 8:56-65; *see also TIP Systems, LLC v. Phillips & Brooks/Gladwin, Inc.,* 529 F.3d 1364, 1373 (Fed. Cir. 2008) ("Our precedent is replete with examples of subject matter that is included in the specification, but is not claimed.")

Petitioner also disingenuously contends that Dr. Sims affirmed that BCP is a matrix material in the '164 patent (Reply, 3), despite his clarification under oath that his statement about BCP being a matrix material was "erroneous" because he was thinking of "the example table" in the '164 patent, and that BCP is being doped into the NBP matrix in col. 8:56-65. EX1043, 88:24-90:8. BCP is clearly disclosed as a dopant in the passage in question, which is the relevant inquiry. EX1001, 8:56-64 (describing "doping in an electron transport material, for example, BCP" to "an NBP matrix."); EX2033 (Holmes), 75:15-16 ("doping" refers to a "dopant").

Moreover, Dr. Sims testified that when a component is described as doped into a matrix that implies the matrix already exists (EX1043, 90:14-21) and that the

'164 patent "does not mention a matrix composed of NPB, BCP, or UGH4" (EX1043, 91:2-4). Petitioner further attempts to distract from the express teachings of the '164 patent by conflating a given chemical composition with its particularly-disclosed usage in a specific system. Even if a compound could serve as both a host and a dopant, the material's specific role in a particular system—*i.e.*, whether it serves as a host/matrix material or a guest/dopant— depends entirely on how it is being used in the particular system. For example, in Choulis, PBD serves as both a dopant in the light emitting layer, as well as a matching layer, as Dr. Holmes confirmed. *See id.*, [0031] ("PBD is also used as a LUMO matching layer (or interfacial layer) between the light emitting layer 305 and a cathode 350."); EX2033 (Holmes), 88:1-7, 92:23-93:3, 88:25-89:3. See below.

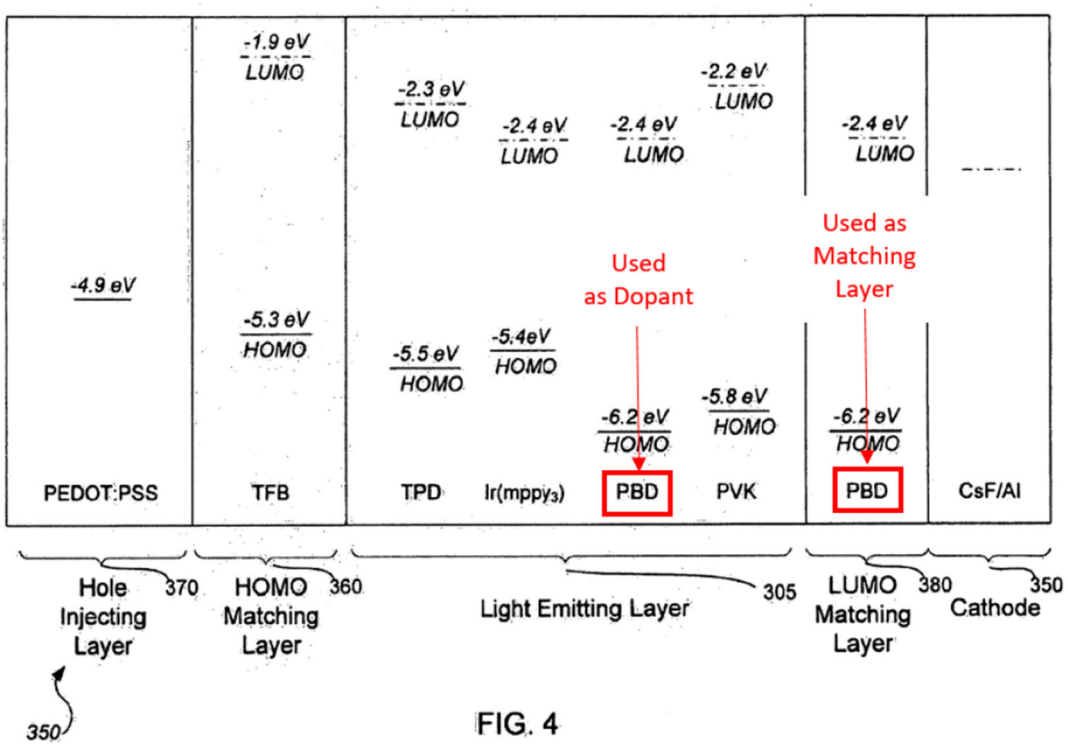


FIG. 4

EX1004, FIG. 4 (annotated); EX1022, 203502-1 (PVK host "doped with" TPD and PBD") *versus* 2023502-2 ("PBD …based electron injected interfacial layer").

In response to Pictiva's argument that the specification's disclosure of simultaneously evaporating the matrix materials supports Pictiva's position (POR, 20), Petitioner fixates on the claims not expressly requiring evaporation (Reply, 5), but does not dispute that the disclosed evaporative process generates a more or less "continuous" phase of the three matrix materials (*i.e.*, a matrix composed of the three matrix materials), unlike solution-based approaches in Choulis, Sugiura and Thompson. Petitioner's reply ignores the canon of claim construction that the claims are to be read in light of the specification. *See Phillips*, 415 F.3d at 1315 ("The claims … do not stand alone."); *see id*. at 1316 (citing and quoting *Netword, LLC v. Centraal Corp*., 242 F.3d 1347, 1352 (Fed. Cir. 2001) ("The claims are directed to the invention that is described in the specification; they do not have meaning removed from the context from which they arose.")). Even then, the most natural reading of claim 1, which recites the emitter material (a dopant) separately from the matrix materials, is that matrix materials are distinct from dopants. POR, 10. Notably, Petitioner is unable to identify any passage in the specification that supports its position that matrix materials include dopants or dispersed agglomerations. *See supra*, p. 4 (explaining that the '164 patent does not suggest at col. 8:56-64 that BCP is a host or matrix material).

B. The District Court and Petitioner's New Claim Construction Supports Patent Owner's Position That Matrix Materials Do Not Include Dopants.

The district court adopted Samsung's construction that the claimed matrix materials "***are part of the same matrix***." EX1030, 32-34, 50. And, even though the Petition represented that no "specialized constructions are necessary," the Reply and Dr. Holmes' reply declaration now pivot to the district court order, adopting the same understanding. Reply, 4 ("The term 'matrix' in 'matrix material' indicates that the material ***is part of the same matrix***."); EX1044, ¶7 (same). Notably, that construction of "matrix material" references the term "matrix," which Samsung separately argued means "a continuous phase of ***the*** mixture of matrix materials" (*id*.), a position with which Dr. Holmes agrees. *See* EX2033, 60:9-12 (Holmes agreeing with Samsung's construction of "matrix"); EX2020 (Holmes), 95:19-22, 275:8-11; EX2016 (Schubert), ¶129.

Each ground hinges on Petitioner's argument that dopants and/or dispersed agglomerations can qualify as matrix materials because matrix materials can include materials embedded in the matrix, and not just materials forming the matrix. DI, 29; POR, 26-33 (Choulis), 54-57 (Sugiura), 61-63 (Thompson). Grammar and logic dictate that substances ***embedded*** in a matrix are foreign to the matrix and are not "part of the same matrix," per the district court's construction adopted by Petitioner in reply. Dr. Schubert recognized a distinction and, citing to supporting extrinsic

evidence that a matrix is more or less continuous matter "in which something is embedded." he testified that the emitter material "is housed in the matrix" and that the matrix is "a connected structure that holds, e.g., the emitter material." EX2016, ¶¶129-130).

Dr. Sims agrees that "a 'matrix material' refers to a material in a more or less continuous phase into which other materials can be embedded," citing to the same and additional supporting evidence as Dr. Schubert. EX2019, ¶¶34-35; EX1043, 36:7-9 ("[A] matrix is a surrounding medium, which implies something is being embedded in it."). Dr. Holmes refused to take a position on whether there is a distinction between embedding something in a matrix versus something being "part of a matrix" and that "it's not something [he] considered in detail." EX2033, 71:14-72:1, 72:6-12. This is fatal to Petitioner's challenge because dopants are embedded materials[2] and, as it stands post-institution, under Petitioner's own definition there is not substantial evidence supporting its theory that materials embedded in a matrix are matrix materials.

[2] *See* EX1044, ¶6 (Dr. Holmes testifying that "[t]he term 'dopant' merely refers to a component that has been added to a film or functional layer."); EX1043, 40:9-11 ("A dopant is a material that is housed in a matrix.").

Testimony from Petitioner's and Samsung's experts that discontinuous dopants and dispersed agglomeration are not part of the matrix is in accord. *See* EX2020, 273:3-5 (Dr. Holmes testifying that "for something to be a matrix, it should have continuous character, not be discontinuous …."), 96:5-11 (testifying that Sugiura's materials 3B and 3C are "not a matrix themselves" and are "drawn as discontinuous"); EX2018 (Schubert), 114:13-21 (Dr. Schubert testifying that Sugiura's 3B and 3C are not "a continuous phase of matrix materials. But rather agglomerations of materials as expressed by the circle features or circular features"), 115:14-23 (confirming that dopants which form islands are not matrix materials). This also explains why emitters are consistently described as dopants in the '164 patent, because as Dr. Sims explains, emitter molecules need to be "kept separately from one another" and "be discontinuous." EX1043, 48:25-49:14; EX2016, ¶129 (Schubert testifying that the matrix provides "stable housing of the emitter material").[3]

Instead of engaging on how embedded materials, such as dopants and dispersed agglomerations, are matrix materials under its new construction, Petitioner

[3] Forrest does not dictate otherwise. Forrest's layers are vertically continuous to provide conductive pathways through the respective layers, and therefore are not dispersed agglomerations, as Dr. Sims confirmed. EX2019, ¶¶61-63.

stands pat citing repeatedly to the Board's preliminary statements about matrix materials, without explaining how the evidence supports that an embedded material is part of the matrix. EX1044, ¶7 ("matrix material" is "part of the same matrix"); EX2033 (Holmes), 60:9-12 (agreeing with Samsung's construction of "matrix"). An IPR trial is meant to develop the evidentiary record on case dispositive issues, not rest on what was available to the Board at institution.

Given the district court's and Petitioner's new construction of "matrix materials" as being "part of the same matrix," combined with the overwhelming weight of expert evidence that "materials embedded within the matrix" (DI, 29) are not part of ***the*** matrix, a key issue on which Dr. Holmes refused to opine, the record does not support that "materials embedded within the matrix" are matrix materials.

C. The Extrinsic Evidence Is Consistent With the Intrinsic Record.

Petitioner mischaracterizes the specification in stating that "the '164 patent also identifies a charge transport matrix material as a dopant," citing to the passage at 8:62-64. Reply, 6. But that passage clearly describes BCP as a dopant being used to adjust relative transport characteristics, and the term "matrix material" does not appear in that passage. *See supra*, 4.

Petitioner's citation to Thompson undermines, rather than supports, Petitioner's argument. Thompson notes that "charge carrying materials [] are typically used as the predominant component, if not sole component, … [but] may

be used in the present invention as the charge carrying dopant material ***in an inert matrix***." EX1007, [0025] (cited in Reply at 6). That the dopant is "in" and not "of" an inert matrix means the dopant is external to the matrix: a fish may be in water, but a fish is not part of the water.

In citing to this passage, Petitioner again commits the error of conflating a material's chemical composition or properties with its particularly-disclosed usage in a given system. *See supra*, Section II.A. Here, Thompson describes that charge carrying materials are typically the predominant/sole component (host), but that in his system the material is instead being used as a dopant (guest) which is added to an inert matrix. This only demonstrates the importance of focusing on the expressly disclosed usage of a material in a given system, as opposed to the chemical composition of the material itself, when evaluating whether the material is a matrix material or a dopant.

Finally, Petitioner's reliance on Li is misplaced. Li is a 2020 article and does not reflect the use of the term "host" at the time of the invention. Not only could Dr. Holmes not recall ever seeing the term "supplementary host" used outside of Li (EX2033, 82:2-15), he could not identify any literature describing a dopant as being a host or co-host at the time of the invention. EX2033, 86:8-15. Moreover, in Li the doping concentrations of CzSi are 2-8 wt% (EX1033, Abstract, 3441), and therefore

CzSi would not be expected to be in a continuous phase with the "main host material," but instead would be a dopant. EX1043, 106:18-107:8.

In sum, the Board should construe matrix materials in accordance with the clear intent of the specification to distinguish matrix materials from dopants and the like. This is consistent with the district court's and Petitioner's new construction, and the combined expert testimony and other extrinsic evidence.

III. Ground 1: Choulis Does Not Anticipate or Render Obvious Claims 1-8 and 10-16.[4]

A. Choulis's TPD and PBD Are Dopants, Which are Not Encompassed by the Term "Matrix Material."

Petitioner's argument under Ground 1 follows the same flawed pattern as its claim construction arguments, *i.e.*, if a material is described as a host or matrix material in one system, it is a host or matrix material in all systems. That is patently false, as demonstrated by Petitioner's own prior art. *See supra*, Section II.A (Choulis uses PBD as a dopant in the light emitting layer, but separately uses it as a matrix material in the LUMO matching layer 380); EX1007 (Thompson), [0025]-[0026] ("charge carrying materials that are typically used as the predominant component, if not sole component" for a charge transport layer, may be used as a "dopant material

[4] The Petition fails to set forth a proper obviousness challenge. POR, 31-33. Petitioner is limited to anticipation, as its expert confirmed. EX2020, 167:5-168:12.

in an inert matrix" in an emission layer).

Petitioner also argues that "matrix materials" can include dopants. *See* Reply, 8. This is wrong under Petitioner's own construction that matrix materials "are part of the same matrix." As described above, dopants are embedded materials and embedded materials are not part of the matrix. *See supra*, Section II.B. But even if "matrix materials" ***could*** include dopants in ***some*** systems, Petitioner has not established that the dopants (TPD and PBD) in Choulis' system are in fact matrix materials, particularly where Choulis itself discloses using PBD as the sole host in the matching layer), but as a dopant in the actual light emitting layer. Tellingly, in arguing for the substitution of PMMA for PVK for certain dependent claims, Petitioner honors Choulis' disclosure that PVK is being used a host material (Reply, 10), but then refuses to honor Choulis' express disclosure that TPD and PBD are used in the light emitting layer as dopants.

Even if, as Petitioner says, Choulis' description "does not ***preclude*** TPD and PBD from being considered matrix materials," that does not mean it taught using them as matrix materials, especially given that Dr. Holmes only analyzed claim 1 under anticipation. EX2020, 167:5-168:12. It is not Patent Owner's obligation to show that Choulis' chemical compositions (TPD and PBD) can never be matrix materials. Rather, it is Petitioner's obligation under anticipation to establish, by a preponderance of the evidence, that those compositions are in fact being used as

matrix materials in the particular system of Choulis. Petitioner has not done so.

Finally, Petitioner's concerns about indefiniteness are misplaced. Reply, 9. As noted in the POR, the Board need not determine all that qualifies as a matrix material, only that when a prior art reference explicitly discloses using a chemical composition as a dopant, a POSITA would not understand the reference as expressly or inherently disclosing that the chemical composition is a "matrix material" in that system.

B. Choulis Does Not Anticipate or Render Obvious Claims 2, 4 and 15-16

Petitioner argues for the substitution of PMMA in place of PVK "to minimize or prevent charge transport in the first matrix material" because PMMA is a wider energy gap insulating material. Reply, 10. But why is minimizing or preventing charge transport desirable? And, if minimizing or preventing charge transport in the first matrix material is so universally desired, why does Choulis use PVK, a hole transport material, in the first place? Choulis hints that PVK was chosen to "ensure the confinement of the triplet excited state in the $Ir(mppy)_3$ guest phosphorescence molecule, and thus prevent luminescence quenching." EX1022, 2; POR, 36-37. As noted in the POR, there is no evidence in the record that PMMA can similarly confine the triplet energy of $Ir(mppy)_3$ in Choulis's emissive layer, nor does Petitioner's Reply even attempt to address the issue. Petitioner leaves these important questions unanswered. Thus, even if a POSITA ***could*** have used PMMA

in some arbitrary systems, Petitioner has not established that a POSITA ***would*** have done so in Choulis.

Regarding Yang, Petitioner does not dispute that Choulis used Yang's optimized emission layer formulation or that Yang limits system to PVK-based formulations. EX2019, ¶¶70-72. Regarding Petitioner's erroneous conclusion that Yang shows it is standard practice to tune the composition of the hole transporting material TPD in PVK, the authors are experts, not POSITAs, as Dr. Holmes confirmed. EX2033, 132:2-24.

C. Choulis Does Not Anticipate or Render Obvious Claim 10

Pictiva explained why a POSITA would not have used rubrene in Choulis's particular system. *See* POR 42-43. Petitioner has no answer for that. Petitioner argues that the specified energy level difference is not a "must", but presents no evidence that the resulting system would even work, let alone operate sufficiently well to motivate a POSITA to use rubrene instead of Choulis' Ir-complex.

D. Choulis Does Not Anticipate or Render Obvious Claims 13 and 14

Petitioner argues that Choulis's materials are applied simultaneously in spin coating, but spin coating tends to cause phase separation—a fact that Dr. Holmes does not dispute, further suggesting that Choulis does not have three matrix materials. EX1043, 65:6-17, 109:1-11, 111:4-13.

Dr. Holmes confirmed that "Choulis does not propose using evaporative process with polymers," like PVK. EX2020, 173:1-11. Petitioner also has not established that a POSITA would have been motivated to apply Choulis' PVK by evaporation coating, per claim 14. See *infra*, Section IV.

Finally, Petitioner argues that Choulis discloses that small molecules can be used as alternatives to PVK, but makes no attempt to show that any such unspecified small molecules would satisfy the claims' HOMO/LUMO levels. EX2019, ¶102.

IV. Ground 2: Choulis and Yong Do Not Render Obvious Claim 9.

Before the Reply, Dr. Holmes acknowledged that his proposed Choulis-Yong combination used Yong's evaporative process. EX2020, 172:2-8 ("I'm using Yong with evaporation."). The Reply states, however, "OLEDs utilizing ***solution-processed*** layers with a gradient in the emitter composition were well established in the field." Reply, 19. That argument is irrelevant given that Dr. Holmes' theory is still based on Yong with evaporation. EX1044, ¶53. But if Petitioner intends to now rely also on solution-based processes, that is a new theory that the Board should disregard. But even if considered, Petitioner still has not shown patentability.

For example, the Reply reiterates that the use of gradients was allegedly well known, but fails to appreciate that in those cases, there was a concentration gradient of electron and hole transports through the emission layer. *E.g.*, EX1009_Yong, 10/33 (noting "a non-linear decreasing trend along the direction from the electron

transporting layer to the hole transporting layer" which limits the efficiency and brightness of uniformly doped dyes); EX1039_Chang, 574 (like Yong, because Chang's PVK only transports holes and not electrons, "the carrier recombination zone [is] closer to the cathode due to the highly unbalanced transport properties of holes and electrons"). In contrast, Dr. Holmes confirmed that Choulis has no such charge carrier gradients. EX2033, 126:3-17. Thus, even if Choulis's devices are not "without imperfections," (Reply 18), the fact remains that Choulis's emissive layer does not have a charge carrier gradient as in Yong. Yong "make[s] the distribution trend of phosphorescent dyes in the host material conform to the distribution trend of electrons in the host material." EX1009 at 10/33. Thus, under Yong's operating principle, to make the distribution of Ir-emitter conform to Choulis' uniform distribution of electrons, the Ir-emitter should also be uniformly distributed. Simply put, Yong does not teach or suggest using a gradient in systems which no do not have a charge charrier gradient, as is the case in Choulis.

Concerning the reasonable expectation of success, in particular, the use of evaporation to process PVK, the new references Chang and Wu actually further evidence that a POSITA would ***not*** have undertaken the proposed Choulis-Yong combination, which deposits matrix materials, including PVK, by evaporation. EX2020, 174:2-5 (confirming reliance on PVK evaporation for claim 9); *see also id*., 174:6-14 (confirming no small molecule alternative for PVK). Specifically,

Chang discloses that "the PVK layer [was] prepared ***by spin coating***," same as Choulis. EX1039, 575 (using solution based process for PVK and evaporation for small molecule TAZ); EX1004, [0042], [0048]. Wu similarly applies PVK by solution processing. EX1040, 794, ("The capability of ***solution processing of polymers*** leads to manufacturing advantage for large-area coating.").

Thus, Wu and Chang shows a POSITA would not have evaporated PVK, a polymer and not a small molecule compound. *See* EX2020, 173:8-11 (Dr. Holmes confirming that "PVK is a polymer material" and "is not considered to be a small molecule material"). Choulis teaches expressly that "***polymeric materials [] are applied as solutions or suspensions***" while "small molecule light emitting materials are preferably deposited through evaporation." EX1004, [0043]; *see also* [0048] (using ink-jet printing or spin-coating to process polymer organic layers and evaporation to deposit small molecule materials). A POSITA reading Choulis as a whole would understand that a polymer like PVK is ***not*** to be evaporated.

Indeed, Dr. Holmes testified that he is not aware of any literature or anyone who has used evaporation to apply PVK. EX2020, 163:13-165:6; EX1043, 25:20-23 (Dr. Sims testifying that "evaporation-processed polymer OLED systems" is "something that a POSITA wouldn't attempt to do."); EX2033, 46:2-16 (Dr. Holmes not aware of any instance in which evaporated PVK was used to make a phosphorescent OLED before or even after the '164 patent).

Petitioner apparently argues that because Djobo does not expressly discourage using evaporative process to apply PVK, it suggests depositing PVK by evaporation. That is wrong as a matter of law. *Rembrandt Wireless Tech., LP v. Samsung Elecs. Co. Ltd*., 853 F.3d 1370 1379-80 (Fed. Cir. 2017) ("[T]the absence of a formal teaching away in one reference does not automatically establish a motivation to combine it with another reference in the same field."). At any rate, Petitioner does not explain why a POSITA would have ignored Choulis' express teaching on how to process polymers for its systems, especially given the known decomposition of PVK during evaporation and the general understanding that decomposition was undesirable. EX1044, ¶47 & EX2033, 28:11-18 (Holmes acknowledging degradation in Djobo); EX2033, 23:3-19 (Holmes testifying that "when you're processing an OLED, you don't want decomposition."); EX1023, Abstract (with "thermal evaporation there is a shortening effect of the chain length …."); EX2019, ¶100.

Dr. Holmes also does not state that after decomposition, the system would still meet the required HOMO/LUMO levels. Nor has he considered whether PVK evaporation that led to undesirable decomposition would be compatible with Choulis's PHOLED systems. EX1003, ¶86 (using $Ir(mppy)_3$ as the emitter); EX2033 (Holmes), 16:22-24, 21:11-20, 29:24-30:1 (did not consider emitter sensitivity to quenching, decomposition during evaporation, or radical formation). Indisputably,

Djobo's Alq_3-based device is not a PHOLED and is not affected by "a triplet quenching mechanism." EX1023, 132 ("the emission originates from the Alq_3"); EX2033 (Holmes), 33:21-23, 35:20-25, 44:23-45:1. In contrast, Choulis's PHOLED is more sensitive to sources that could lead to triplet quenching. EX2019, ¶79; EX1043, 54:2-5; EX2033 (Holmes), 28:11-18; EX2020, 306:10-309:3 & 315:4-316:2 (describing differences between phosphorescent emitters and fluorescent emitters and the need to "[re]move every possible loss in order to get that high efficiency" in PHOLEDs). Thus, Petitioner's reliance on Djobo for motivation is misplaced because "Djobo is not considering a phosphorescent emitter." EX2033 (Holmes), 45:20-22. Simply put, Petitioner has not established that a POSITA would deviate from Choulis's express teachings and adopt a different process (evaporating PVK) that would have been expected to reduce its PHOLED's efficiency.

V. Ground 3: Sugiura Does Not Anticipate or Render Obvious Claims 1, 3, 5-8, and 10-13.

Petitioner on reply repeats the same logical fallacy of equating a material's composition with its role in a given system. The fact is that a hole transport material can be used as a matrix material in one system and as a dopant in another, or even within the same system, as Choulis does with PBD. *See* EX1004, [0031] ("PBD is also used as a LUMO matching layer (or interfacial layer) between the light emitting layer 305 and a cathode 350."); see below.

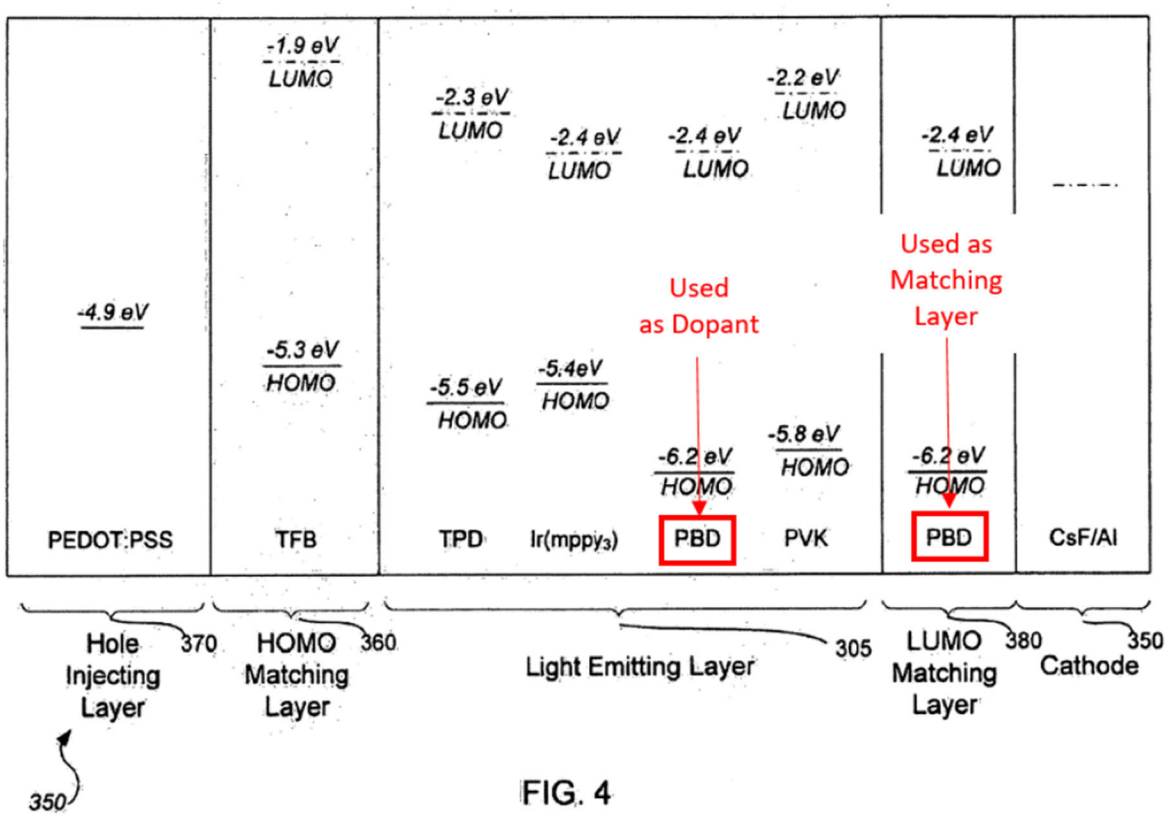


FIG. 4

EX1004, FIG. 4 (annotated); EX1022, 203502-1 (PVK host "doped with" TPD and PBD") *versus* 2023502-2 ("PBD …based electron injected interfacial layer").

Petitioner next argues that Sugiura discloses matrix materials because the term matrix materials does not exclude dispersed agglomeration or dopants. Reply, 20. But under Petitioner's own construction, the term matrix materials refers to materials which are part of the matrix, not materials embedded in the matrix, such as dispersed agglomerations and dopants. *See supra*, Section II.

Petitioner next argues that Sugiura's hole and electron transport materials are not dispersed agglomerations based on the weight ratio given in Sugiura. However, that is unsupported attorney argument as Dr. Holmes explicitly declined to rely on

Sugiura's weight ratio. EX2033, 136:7-18. In any event, as Dr. Sims testified, one would need to know the "equivalent molar ratio," not the weight ratio, to deduce whether Sugiura's hole and election transporting material are sufficiently close to each other to be able to effectuate transport. *See* EX1043, 66:5-6 ("We need to know what the equivalent molar ratio is for this."), 108:12-15. And on that point, Dr. Holmes confirmed that Sugiura's molar ratio would be substantially different than the weight ratio. EX2033, 152:5-11. As such, without the molar ratio, one cannot draw a meaningful conclusion from Sugiura's weight ratio, which in any event Dr. Holmes did not rely on.

Petitioner mischaracterizes Dr. Sims' testimony about the role of hole and electron transport materials, generally, referenced on p. 21 of Petitioner's Reply. He did not confirm anything about Sugiura's specific materials being in sufficient concentration to facilitate transport. *See* EX1043, 65:22-66:6 (testifying that "[i]t is difficult to say" if Sugiura's hole transporting material are sufficiently close to each other to be able to transport holes because "[w]e need to know what the equivalent molar ratio is for this ratio."), 67:2-5 (in response to question about Sugiura's electron transporting material being close enough to transport electrons, testifying "***I don't know***, but ***if*** there is anything that is going to be transporting electrons in that system, it would be designed to do that with Alq3.")

Petitioner also incorrectly contends that "***[i]mportantly***, the term 'dispersed

agglomerations' is introduced by PO" (Reply, 21), but in fact, it was Samsung's own expert, Dr. Schubert, who first coined the term in the context of Sugiura. *See* EX2018 (Schubert Tr.), 114:13-21 (describing 3B and 3C in Sugiura's figures as "***agglomerations*** of materials as expressed by the circle features or circular features" and "not a matrix because it does not include a continuous phase of matrix materials"). *See Vas-Cath, Inc. v. Mahurkar*, 935 F.2d 1555, 1565 (Fed. Cir. 1991) (stating that there is no "legal significance whether the disclosure is found in the specification or in the drawings so long as it is there.").

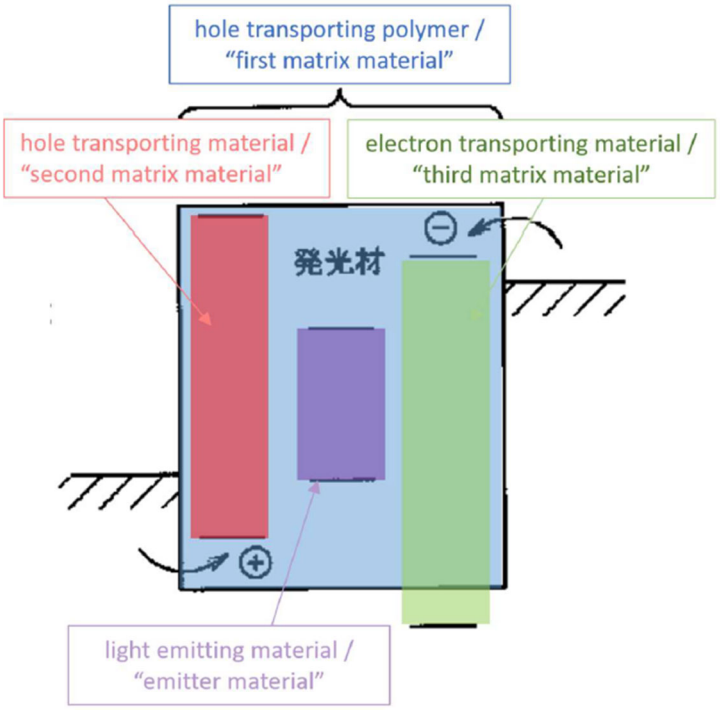
And, while Petitioner attempts to distance itself from Sugiura's express disclosure by contending the figures are "merely simplified illustrations," Dr. Schubert was comfortable drawing conclusions about those materials from the figures, as noted above. At any rate, Petitioner does not deny that those figures are part of Sugiura's express disclosures.

And Dr. Holmes had no reservations relying on ***only*** visual inspection of Figure 8 to draw his conclusions about relative LUMO/HOMO levels which are otherwise undisclosed. EX1003, ¶¶180-181. Petitioner cannot wrap itself in Sugiura's figures to satisfy certain limitations that otherwise find no support in the specification, but then turn around and distance itself from those same figures when they happen to contain other disclosure contradictory to its arguments.

Regarding whether forming dispersed agglomerations would prevent Sugiura

from achieving its stated objections, Petitioner's chop-quote of Dr. Sims testimony leaves out his explanation that, despite Sugiura's efforts, "spin coating is a process which is very turbulent" and "it is really hard to get a fine mixture" and that "they were probably aware of this, and that's why they drew the schematic the way they did." EX1043, 65:2-17.

Dr. Sims testified about specific disclosure in Sugiura, confirming that a POSITA would understand Sugiura's hole and electron transport materials are dopants, and not part of the same matrix. Specifically, with respect to Figure 8, which corresponds to Figure 4, Dr. Sims testified that "the top and bottom lines confining that box are denoting the HOMO and LUMO level of PVK," which is "the overall matrix." EX1034, 98:1-9. Dr. Sims explained that "then within that, you see some other energy levels, again, HOMO and LUMO levels, of constituent molecules … that are doped into the PVK, which is the overall host matrix material." *Id*., 98:9-14. Dr. Sims explained that the matrix box of Figure 8 "is a conventional way to show this is a matrix." *Id*., 98:17-24. Dr. Holmes' own annotations of Figure 8 are consistent. Specifically, Dr. Holmes colors the entire box in blue and labels it as "hole transporting ***polymer***," where the upper and lower lines defining the box correspond to PVK, with the other constituent materials shown as embedded in the blue box with separate HOMO/LUMO lines (which notably do ***not*** define the box) for their corresponding energy levels.



EX1003, ¶180 (Dr. Holmes' annotation of Sugiura, Fig. 8). The Reply does not dispute Dr. Sims' understanding of what the matrix box represents in Sugiura's Figure 8.

Likewise, in Fig. 4 of Thompson, element 40 corresponding to the box is the "wide gap host material layer" "defin[ing] the emissive region of the OLED, which comprises a doped layer containing the charge carrying dopant material and the phosphorescent dopant material." EX1007, [0034], Fig. 4.

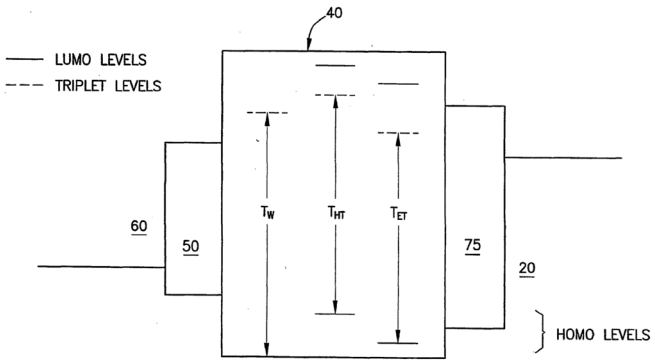


Fig. 4

Like Sugiura's matrix box, Thompson's matrix box corresponds to the "host" material and the dopant materials are depicted as embedded in the matrix box with HOMO/LUMO bars separate from the matrix box. Indeed, Thompson explicitly refers to the host material 40 as the "matrix material" (EX1007, [0035]) and the hole transport and electron transporters as "dopant material." *Id*., [0039]-[0040].

VI. Ground 4: Thompson Does Not Anticipate or Render Obvious Claims 15-16

Contrary to Petitioner's contention (Reply, 24), the POR ***did*** contend that Thompson's hole transporter (HT), and electron transporter (ET) are dopants, as they are referred to throughout Thompson's disclosure, and ***not*** part of the same matrix. POR, 61-63. Thompson's matrix box confirms that the HT and ET dopants are not part of the matrix formed by the host material 40. *See supra*, Section V.

Moreover, as with Choulis and Sugiura above, Petitioner has not shown that Thompson anticipates the claims by expressly or inherently disclosing that its

particular hole and electron transporters "***are part of the same matrix***," under the district court's and Petitioner's new construction. *See supra*, Section II.B.

Dated: September 17, 2025

Respectfully submitted,

By: /Jonathan M. Lindsay/

H. Annita Zhong (Reg. No. 65,530)
IRELL & MANELLA LLP
1800 Avenue of the Stars, Suite #900
Los Angeles, CA 90067-4276
Telephone: (310) 203-7183
hzhong@irell.com

Jonathan M. Lindsay (Reg. No. 45,810)
IRELL & MANELLA LLP
840 Newport Center Drive, Suite 400
Newport Beach, CA 92660
Tel: (949) 760-0991
Email: jlindsay@irell.com

Counsel for Patent Owner
Pictiva Displays International Ltd.

CERTIFICATE OF WORD COUNT

I hereby certify, pursuant to 37 C.F.R. section 42.24, that the foregoing Patent Owner Sur-Reply contains 5,571 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 document.

/Jonathan M. Lindsay/
Jonathan M. Lindsay

CERTIFICATE OF SERVICE

I hereby certify, pursuant to 37 C.F.R. section 42.6, that on September 17, 2025, a complete copy of the foregoing document **PATENT OWNER SUR-REPLY** and **EXHIBITS 2033 and 2105-2109** were served by electronic mail, as agreed to by the parties, upon the following:

COVINGTON & BURLING LLP

Scott C. Weidenfeller (Reg. No. 54,531)
sweidenfeller@cov.com

David A. Garr (Reg. No. 74,932)
dgarr@cov.com

Hyun S. Byun (Pro Hac Vice)
hbyun@cov.com

SDC-Pictiva-IPR@cov.com

/Pia S. Kamath/
Pia S. Kamath