

UNITED STATES DISTRICT COURT
EASTERN DISTRICT OF TEXAS
MARSHALL DIVISION

Pictiva DISPLAYS INTERNATIONAL
LTD., *et al.*,

Plaintiffs,

vs.

Samsung ELECTRONICS CO., LTD.,
Samsung ELECTRONICS AMERICA,
INC.,

Defendants.

Civil Action Nos.
2:23-cv-00945-JRG
2:24-cv-00532-JRG

**EXPERT REPORT OF IOANNIS KYMISSIS, PH.D.,
REGARDING THE VALIDITY OF U.S. PATENT NOS.
8,558,223 AND 8,723,164**

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	e. [15i] wherein the first matrix material has a LUMO which is energetically higher than the LUMO of the second matrix material and the LUMO of the third matrix material, and a HOMO which is energetically lower than the HOMO of the second matrix material and the HOMO of the third matrix material.....	373
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c.	[13b] B) preparation of a first electrode and a second electrode; and.....	416
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LIST OF REPORT APPENDICES AND EXHIBITS

Exhibit No.	Description
Exhibit A	Curriculum Vitae of Ioannis Kymissis, Ph.D.
Exhibit B	List of Materials Considered
Exhibit C	Eurofins EAG iRiver Clix 2 OLED Characterization Project Report

I. Introduction

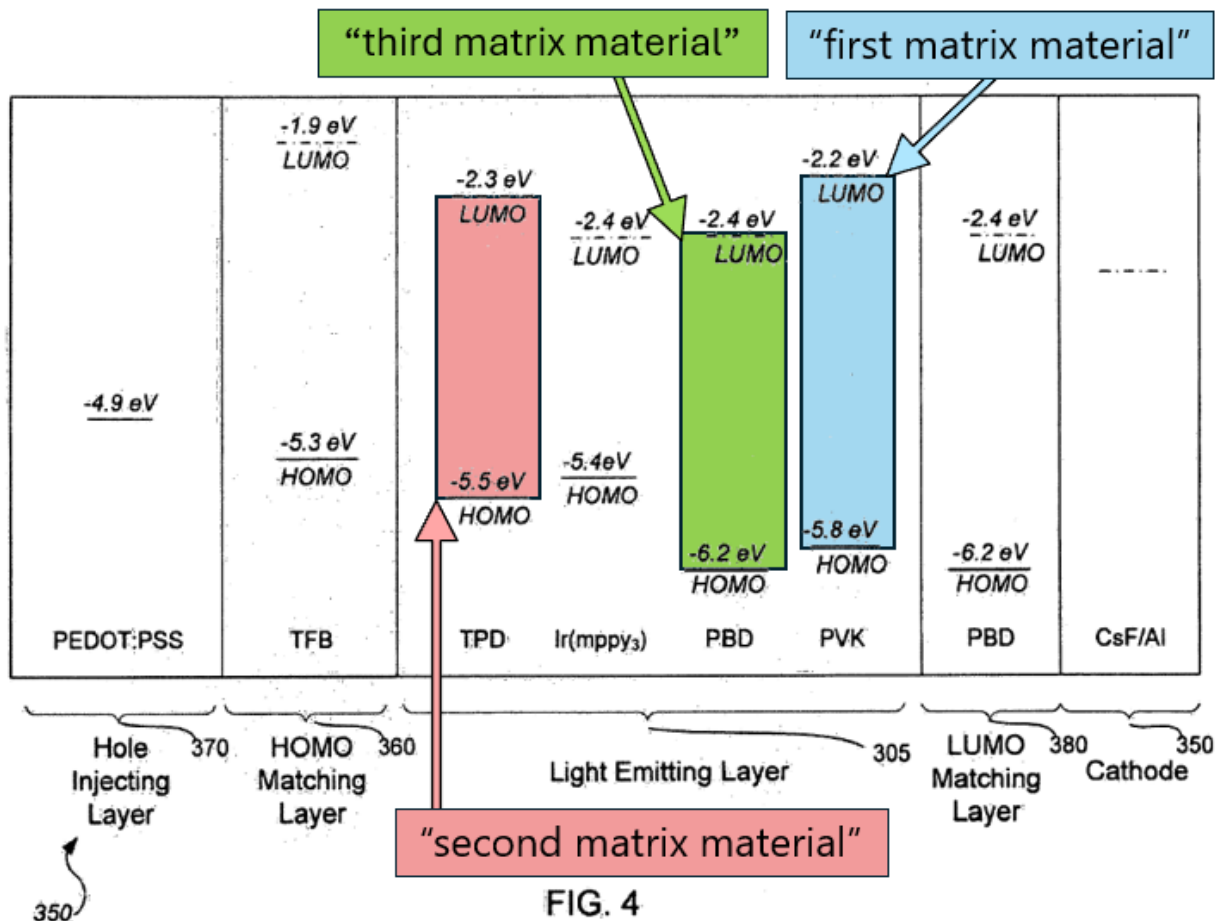
1. My name is Dr. Ioannis Kymissis. I have been retained by counsel on behalf of the defendants (“Samsung” or “Defendants”) in connection with the above-captioned action. I have been asked by counsel to offer an expert opinion as to whether the claims of U.S. Patent Nos. 8,558,223 (“the ’223 patent”) and 8,723,164 (“the ’164 patent”) (collectively, “the asserted patents”) asserted by Plaintiffs Pictiva Displays International, Ltd. and Key Patent Innovations Limited (“Pictiva” or “Plaintiffs”) are valid. I expect to testify at trial regarding the matters set forth in this report, if asked about those matters by the Court or the parties’ attorneys.

2. I am being compensated at my standard rate of \$350 per hour (\$700 per hour at deposition) for my time, plus reasonable out-of-pocket expenses. I have received no additional compensation for my work in this litigation, and my compensation does not depend upon the contents of this report, any testimony that I may provide, or the ultimate outcome of this litigation.

II. Basis For Opinion

A. Qualifications

3. Full descriptions of my educational background, professional achievements, qualifications, and publications are set forth more fully in my *curriculum vitae*, which is attached to this report as Exhibit A. Here, I provide a summary of my background and qualifications.

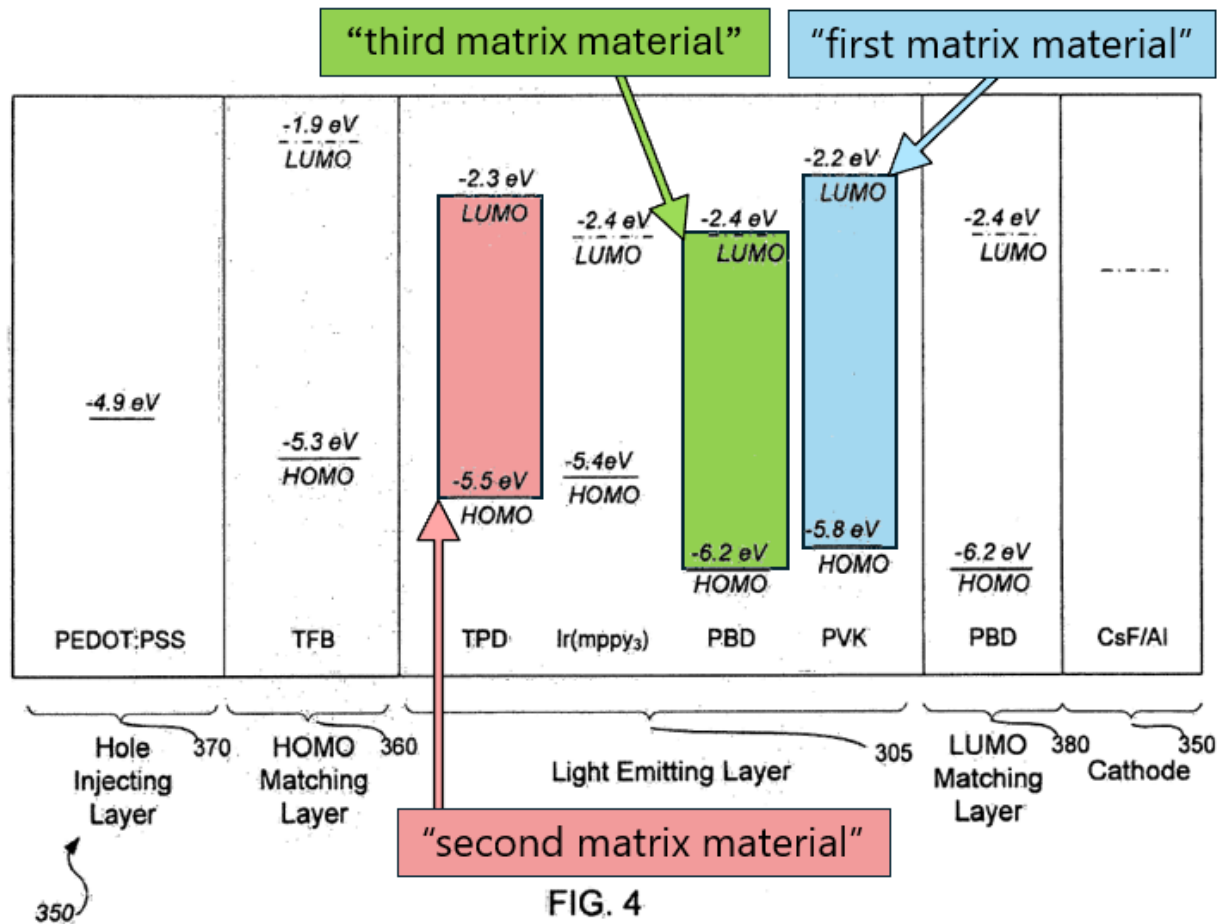


- d. [1h] wherein the second matrix material has a Highest Occupied Molecular Orbital (HOMO), which is energetically higher than the HOMO of the first matrix material and the HOMO of the third matrix material,

808. Choulis discloses the relevant material, and therefore the combination of Clix 2 and Choulis renders this limitation obvious.

809. I discussed the HOMO and LUMO values of the three claimed “matrix materials” in the previous element, which I incorporate by reference here. As shown in the annotated Figure 4 and in the table of HOMO and LUMO values, the second matrix material (TPD) has a HOMO (-5.5 eV) which is energetically

higher than the HOMO (-5.8 eV) of the first matrix material (PVK) and the HOMO (-6.2 eV) of the third matrix material (PBD). Graphically, this is shown in the annotated Figure 4 with the bottom border of the red box being located above the bottom border of the blue box and the bottom border of the green box:⁵³³



- e. [1i] wherein the organic functional layer is an emission layer and is doped with at least one emitter material.

810. Choulis discloses the relevant material, and therefore the combination of Clix 2 and Choulis renders this limitation obvious.

⁵³³ Choulis at Fig. 4 (annotated).

811. The claimed “organic functional layer” in the proposed combination is Choulis’ light emitting layer. This is an emission layer. For example, its function is to emit light.

812. The claimed “emitter material” may be Ir(mppy)₃. In one embodiment of Choulis, “[t]he light emitting layer 305 includes a light emitting material 320, such as an organo-metallic phosphorescent material, a methyl-substituted tris(2-4(4-tolyl)phenylpyridine)iridium (Ir(mppy)₃) complex.”⁵³⁴ Ir(mppy)₃ is suitable for use in a light emitting layer with PBD (the claimed “third matrix material”) because “PBD has a LUMO level at around −2.4 eV, which is approximately equal to that of the Ir(mppy)₃, and can directly inject electrons into the Ir(mppy)₃.”⁵³⁵ Ir(mppy)₃ is also suitable for use in the light emitting layer with PVK because “PVK has a large band gap and can confine the triplet excited state of the Ir(mppy)₃ phosphorescent molecule, preventing luminescence quenching.”⁵³⁶

813. The claimed “emitter material” may also be rubrene. Choulis discloses in general that “small organic molecules that emit by fluorescence or by phosphorescence can serve as a light emitting material residing in the light emitting layer.”⁵³⁷ Choulis states that “[e]xamples of electroluminescent small

⁵³⁴ Choulis at [0028].

⁵³⁵ Choulis at [0029].

⁵³⁶ Choulis at [0030].

⁵³⁷ Choulis at [0043].

molecule materials include chelates, such as tris(8-hydroxyquinolate) aluminum (Alq_3) and tris(2-phenylpyridine) iridium (Ir(ppy)_3), organic materials, such as anthracene, **rubrene** or triazine, or any metal-chelate compounds or derivatives of any of the organic materials or small molecule materials.”⁵³⁸

814. Either of these emitter materials may be doped into Choulis’ light emitting layer. For example, when discussing example concentrations of materials for the light emitting layer, the emitter material is smallest, at 6%.⁵³⁹ Choulis also describes forming the light emitting layer with “electroluminescent small molecules” such as Ir(mppy)_3 or rubrene, and in context a POSITA would have understood that these materials are doped into the light emitting layer.⁵⁴⁰ In OLED design, “doping” refers to the intentional introduction of a foreign material (or impurity) into a host at low concentrations to modify its electronic or optical properties. This is a well-known concept that a skilled practitioner in the field would recognize. Emission layers often use a guest–host system where the host

⁵³⁸ Choulis at [0043] (emphasis added).

⁵³⁹ Choulis at [0054] (“Referring to FIG. 5, a light emitting device having a phosphorescent light emitting compound is formed with and without matching layers. A control device 430 (without matching layers) is formed with an anode of ITO, a hole transport layer of PEDOT:PSS, a light emitting layer, and a cathode of CsF/Al. The light emitting layer includes 61% PVK, 24% PBD, 9% TPD and 6% Ir(mppy)_3 .”).

⁵⁴⁰ *E.g.*, Choulis at [0043] (“For example, a PLED may be chemically derivatized with a small organic molecule or simply mixed with a small organic molecule to form the light emitting layer. Examples of electroluminescent small molecule materials include chelates, such as tris(8-hydroxyquinolate) aluminum (Alq_3) and tris(2-phenylpyridine) iridium (Ir(ppy)_3), organic materials, such as anthracene, rubrene or triazine, or any metal-chelate compounds or derivatives of any of the organic materials or small molecule materials.”).

material forms the bulk of the emission layer and the guest (emitter) material is added in small amounts. This doping approach enables efficient energy transfer from the host to the emitter, thereby optimizing light emission while preventing issues like aggregation or quenching that can occur at higher concentrations.

5. Claim 2

815. This claim reads: “The electronic device according to claim 1, wherein the first matrix material has a LUMO which is energetically higher than the LUMO of the second matrix material and the LUMO of the third matrix material, and a HOMO which is energetically lower than the HOMO of the second matrix material and the HOMO of the third matrix material.”

816. The combination of Clix 2 and Choulis renders this claim obvious.

817. Choulis discloses that the material PMMA, a material that is an “insulated matrix,” may be used as the claimed “first matrix material” in lieu of PVK.⁵⁴¹ Choulis also generally discloses that its light emitting layer can include a host material with “a high band gap (have a large difference between their HOMO and LUMO levels).”⁵⁴²

⁵⁴¹ Choulis at [0044] (“In some embodiments, the light emitting layer includes materials that are insulated matrices, that is, the host does not have transport properties, such as polycarbonate (PC), polymethyl methacrylate (PMMA) or polystyrene sulphonate (PSS).”).

⁵⁴² Choulis at [0044].