In the matter of
European Patent No. EP1 449 238
and Third Party Observations thereto
Europaisches Patentamt
Munich, Germany
Filed on August 16, 2013

THIRD PARTY OBSERVATIONS

I. Introduction

The following document concerns the facts, evidence, and arguments presented in the oppositions to European Patent No. 1 449 238 ("EP-238"), derived from European Patent Application No. 00932308.0, filed May 11, 2000, as PCT/US2000/012946. **(Reference 1: EP-238)**.

On March 21, 2013, the Board of Appeals ("BOA"), in a communication sent pursuant to Article 15(1) of its Rule of Procedures, raised certain issues to be considered at the Oral Proceedings ordered by the BOA on March 18, 2013, to be held on November 21st and 22nd, 2013. The purpose of the BOA's communication is to assist the parties in preparation of the oral proceedings. Based upon our review of this communication, including the BOA's provisional but not binding views expressed Paragraph 5.1 concerning "every organometallic iridium compound" and Paragraph 5.2 concerning "every OLED" and concerning novelty and inventive step Paragraph 6.1, 6.2, 6.3 and 7, and the record we consider it necessary to make this submission.

As relevant here, an organic light emitting device or OLED has component parts including a pair of electrodes sandwiching two or more layers, one of which contains an *emitter compound.* EP-238 contains extremely broad claims to an OLED in which the *emitter compound* is selected from every *organometallic iridium* or *osmium based compound.*

Yet the evidence shows that Proprietors neither developed any theory nor invented a single component part of the OLED, let alone any organometallic iridium compound. The technical contribution, according to Proprietors, is "the disclosure of ... an OLED, which makes light by phosphorescence." Reply of Dec. 21, 2012, p. 7. But at least two facts contradict Proprietor's assertion. Firstly, EP-238's relevant claims embrace an OLED that produces luminescent emission, i.e., not only phosphorescent but also fluorescent emission. Reply, p. 6. Secondly, at least four prior arts of record—JP-145 [**S7-S8**]; Ma [**D1**], Baldo II [**D2**], DiMarco [**D9**] O'Brien [**D19**][1]—made and/or describe OLEDs which "make[] light by phosphorescence."

Although the BOA found that Baldo II [**D2**] is a closest prior art, the BOA should also appreciate that O'Brien [**D19**] is an improvement of Baldo II [**D2**] and that O'Brien [**D19**] describes the same OLED heterostructure that was used in Example 2 of EP-238, except for minor variations in the thickness of the individual layers and for the particular emitter compound. While prior art O'Brien [**D19**] describes using a single *phosphorescent platinum compound*, EP-238 describes using an already at the time very well-known *phosphorescent organometallic iridium compound* ($Ir(ppy)_3$), which was previously well-characterized by Dedeian, Djurovich, and King (**References 10-12 & 45**). Clearly, to modify prior art O'Brien's [**D19's**] example in a way to reach the embodiment of Example 2 in EP-238 would require a simple substitution, especially in light of JP-145 [**S7-S8**]; Ma [**D1**], Baldo II [**D2**], & O'Brien [**D19**] and the fact that using organometallic compounds to emit phosphorescent luminance has been the focus of experimentation since the early 1970's, as summarized in a review of the luminescent properties of organometallic complexes by Lees [**D10**].[2] Dr. Lees's review touches on various forms of luminescence from osmium complexes[3] and iridium complexes[4]—which identified $Ir(ppy)_3$ has having high-yield phosphorescence.[5]

In light of the BOA's Summons, and knowing these facts, we believe it necessary us to make this filing to the BOA to illustrate the Proprietors' legal dilemma. Proprietors are now requesting claims embracing a tremendous amount of subject matter defined by the extraordinarily large number of both iridium and osmium compounds, *even though Proprietors simply substituted one and only one iridium compound* (Example 2) *into the prior art O'Brien's [D19's] OLED,* which simple substitution Proprietors use to claim their invention was

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[1] See Section IV References for a list of references.

[2] Although dated in 1987, Dr. Lees's review provides many references to work published in the 1970s. See, e.g., Lees [**D10**], pages 711, 740-43.

[3] Lees [**D10**], pages 730-31 for reviews of osmium complexes.

[4] Lees [**D10**], pages 731-37 for reviews of iridium complexes.

[5] Lees [**D10**], page 736 (regarding "'fac-$Ir(PP)_3$," which is $Ir(ppy)_3$ used by EP-238, Lees [**D10**] stated "that the luminescence quantum yield is close to unity....").

dramatic.[6] Proprietors want extremely broad claims despite multiple patent defeating prior arts, such as JP-145 [**S7-S8**]; Ma [**D1**], Baldo II [**D2**], & O'Brien [**D19**].

In their December 18, 2012, filing the Proprietors admit a simple substitution separates fluorescent from phosphorescent OLEDs: "fluorescent OLEDs ***only differ*** from phosphoresecent OLEDs in the type of emitter compound used." (p. 6). Then Proprietors confess that know-how used in fluorescent OLEDs is ***routinely transferred*** to phosphorescent OLEDs ***without hesitation*** and that this is "***self-evident and has ever been self-evident to a skilled person***." (p. 6). Yet after these glaring confessions and admissions Proprietors continue to claim that they did invent "organometallic iridium compounds" as emitters. (p. 8). As a result, Proprietors have to avoid making a direct claim on Ir(ppy)$_3$ or any specific iridium compound. So, in their December 18, 2012, filing the Proprietors refer to Ir(ppy)$_3$ as "an emitter compound," a "certain chemical species," a "disclosure of compounds," and the "emission compound" all to avoid making a direct claim on the use of Ir(ppy)$_3$ or any specific iridium compound.

To defend its position, Proprietors redefined their contribution by pointing to generic and common terms that the Proprietors have not claimed, namely, *phosphorescent* and *organometallic*, and use these terms in EP-238's claims to refer to an emitter compound that is *a phosphorescent organometallic* ***iridium*** or ***osmium*** *compound.* To address these and similar issues, this document discusses other evidence uncovered during the course of this investigation, which we again believe necessary for a meaningful review.

The Proprietors of EP-238 are The Trustees of Princeton University and The University of Southern California, which have licensed their rights in EP-238 to Universal Display Corp. ("UDC"), according to documents filed with the U.S. Securities and Exchange Commission.[7]

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[6] In its September 29, 2011, filing in preparation for the oral proceedings the Proprietors claim that EP-238 was "nothing other than a dramatic breakthrough, open a new field of OLED technology for commercially relevant devices."

[7] This document contains observations and inferences on proceedings whose essential purpose is to determine: What, if anything, done at Princeton University through its Advanced Technology Center for Photonics and Optoelectronic Materials under the supervision of Professor Stephen Forrest at Princeton and Professor Mark Thompson at the University of Southern California in the field of full color flat panel emissive display technology employing crystalline organic and metal/organic semiconductor light emitting diodes, organic semiconductor lasers or other organic technologies constitutes a patentable invention under the laws of the U.S., the E.U., and other jurisdictions. These experiments into Organic Semiconductor Light Emitting Diodes or Devices were funded by the U.S. Air Force Research Laboratory during the period between June 13, 1994, and April 30, 2002. In December 1997, the first patent, titled "Transparent Contacts for Organic Light Emitters", was issued to Princeton University by the U.S. Patent and Trademark Office in connection with the Sponsored Research. In January and February of

EP-238 concerns organic light-emitting devices ("OLEDs") and represents UDC's key OLED patent. Appendix A contains a summary of the content of EP-238. The opponents to EP-238 are Merck, BASF, and Sumitomo Chemical ("Opponents").[8,9]

Opposition proceedings before the EPO allow for the invalidation of a patent's claims, in whole or in part. Opposition proceedings are first conducted at the level of the EPO Opposition Division, which renders a written decision.[10] Any party may then appeal the Opposition Division's decision to the EPO Boards of Appeal, which is recognized as a court, and which follows judicial, rather than administrative, procedures. A brief summary of the opposition proceedings in the EP-238 patent is in Appendix B.

In the opposition proceedings relating to EP-238, the EPO Opposition Division Interlocutory decision in opposition of January 13, 2012 (**Reference 2: EP-238 Opposition Division Decision**), invalidated the Original Claims in EP-238 and the First Auxiliary Request Claims. (**Reference 3a-b: EP-238-Original Claims & First Auxiliary Request Claims, respectively**). UDC's surviving claims are referenced as the Second Auxiliary Request Claims. (**Reference 3c: Second Auxiliary Request Claims**). Three more sets of claims, filed by UDC on December 18, 2012, as further fallback positions for appeal, were never addressed during the opposition. (**Reference 3d-f: Third, Fourth, & Fifth Auxiliary Request Claims**). All parties

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1998, two additional patents relating to Multicolor Organic Light Emitting Devices were issued to Princeton University.

[8] In addition to its perpetual license to EP-238 and other patents owned by Princeton University, UDC is contractually obligated to defend EP-238, according to UDC's disclosures in filings with the U.S. Securities and Exchange Commission. Thus, UDC is referenced throughout this document as the proprietor party for EP-238.

[9] The Opposition was filed by Sumation Co. Limited ("Sumation"). During the Opposition, Sumation became wholly owned by Sumitomo Chemical Company Limited ("Sumitomo"). For convenience, this paper refers to Sumitomo rather than Sumation.

[10] Within nine months of the grant of a European patent, the EP patent may be opposed by a third party if it believes that the EP patent should not have been granted. Typical grounds for opposition include that the subject matter of one or more of the claims is not new or inventive or that the patent does not disclose the invention in a manner sufficiently clear and complete for it to be carried out by a person skilled in the art. The Opposition is heard by an Opposition Division, a panel of three examiners, one of which is likely to have been involved in the substantive examination of the granted EP patent. If it is deemed necessary to resolve issues related to the grant, the Opposition Division invites each party to file observations, within a specific period, on its or other parties' communications. During the observation period, the patent holder (Proprietor) can propose to amend the description, claims and drawings. After these observations, the Opposition, most likely will proceed to an oral proceeding, which is followed by a Decision resulting in one of three orders: (a) to maintain the patent; (b) to revoke the patent; or (c) to maintain the patent in amended form. The Decision ends the Examiner's involvement in the Opposition. However, the Decision is appealable to an independent Board of Appeals.

filed appeals to the EPO Boards of Appeal (**Reference 4: EP-238 Notices of Appeal**), whereby the Opponents are seeking the cancellation of the decision to maintain UDC's EP-238.

The purpose of this Review is to determine whether UDC's EP-238 broadest claims constitute an invention or whether there existed before UDC's EP-238 broadest claims were filed papers and patents ("prior art") that make UDC's EP-238 broadest claims obvious or whether by reading the prior art UDC or others could have easily created all of the parts contained in UDC's EP-238 without an invention. The method we use is to identify UDC's broadest claims in EP-238 and then dissect them and understand the meaning of each part of the claim[11] and compare them to the prior art. This Review will form the basis for an evaluation of the Opponents' main arguments thereby allowing us to render a legal opinion on the outcome of their request for cancellation.[12]

The following Table of Contents facilitates processing.

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[11] Protocol on the Interpretation of Article 69 EPC, Article 1, General principles: Article 69 should not be interpreted as meaning that the extent of the protection conferred by a European patent is to be understood as that defined by the strict, literal meaning of the wording used in the claims, the description and drawings being employed only for the purpose of resolving an ambiguity found in the claims. Nor should it be taken to mean that the claims serve only as a guideline and that the actual protection conferred may extend to what, from a consideration of the description and drawings by a person skilled in the art, the patent proprietor has contemplated. On the contrary, it is to be interpreted as defining a position between these extremes which combines a fair protection for the patent proprietor with a reasonable degree of legal certainty for third parties.

[12] The Opponents request the cancellation of the Interlocutory Decision dated January 13, 2012, to maintain the patent in amended form in accordance to UDC's Second Auxiliary Request Claims contained in Reference 3c.

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II. Identification of Universal Display's Broadest Claims

1. The claims define the rights of a patent. On November 2, 2006, EP-238 was granted with 30 claims (**Reference 3a: Original Claims**), which are dividable into two Groups.

2. Group I is defined as claims 1-15, which are directed to an *electroluminescent layer*, and the subject matter of Group I is represented by claim 1:

> 1. An *electroluminescent layer* comprising an emissive layer including an emissive molecule that is a phosphorescent organometallic iridium compound or a phosphorescent organometallic osmium compound.

3. Group II is defined as claims 16-30, which are directed to an *organic light emitting device* (OLED) including the *electroluminescent layer* from Group I, and the subject matter of Group II is represented by claim 16:

> 16. An *organic light emitting device* comprising a heterostructure containing an emissive layer that produces luminescent emission when a voltage is applied across the heterostructure, wherein the emissive layer includes a molecule that is a phosphorescent organometallic iridium compound or a phosphorescent organometallic osmium compound.[13]

(**Reference 1: EP-238, p. 11, l. 48-p. 15, l. 27**) (showing other claims).

4. Other claims specify more details about the representative claims and therefore narrow their respective base claim. For example, claim 17 requires, in the OLED, that the emissive layer comprises *a host material and the phosphorescent organometallic compound is present as a guest in said host material.*[14] Claim 18 requires, in the OLED, that the emissive molecule is *a phosphorescent organometallic iridium compound*, and claim 19 further requires that the *phosphorescent organometallic iridium compound* is Ir(ppy)$_3$, the structure of which is as follows:

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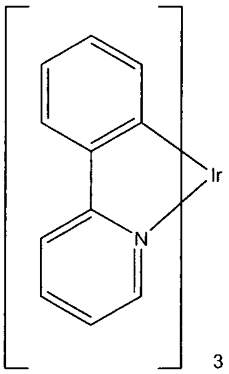
[13] EP-238's description of the OLED is reviewed in Appendix A.

[14] In this context, the guest is the dopant as elaborated on in Appendix A.



Ir(ppy)$_3$.

(Reference 1: EP-238, p. 13, ll. 41-52).

5. UDC's claims in the First Auxiliary Request Claims (**Reference 3b: First Auxiliary Request Claims**) are directed to the subject matter of Groups I-II, but these claims do not embrace the *phosphorescent organometallic osmium compound.* With markings to show the differences relative to the original claims, the claims of the First Auxiliary Request Claims read as follows:

> 1. An *electroluminescent layer* comprising an emissive layer including an emissive molecule that is a phosphorescent organometallic iridium compound ~~or a phosphorescent organometallic osmium compound~~.
>
> ~~16.~~ 13. An *organic light emitting device* comprising a heterostructure containing an emissive layer that produces luminescent emission when a voltage is applied across the heterostructure, wherein the emissive layer includes a molecule that is a phosphorescent organometallic iridium compound ~~or a phosphorescent organometallic osmium compound~~.

6. UDC's claims in the Second Auxiliary Request Claims (**Reference 3c: Second Auxiliary Request Claims**) are directed to the subject matter of Group II from the First Auxiliary Request Claims. Of course, the claim numbering differs between UDC's First and Second Auxiliary Request Claims.

7. UDC's claims in the Third Auxiliary Request Claims (**Reference 3d: Third Auxiliary Request Claims**) are directed to the subject matter of Group II from the Second Auxiliary Request Claims, but the Third Auxiliary Request Claims narrow the *phosphorescent*

organometallic iridium compound to *phosphorescent cyclometallated organometallic iridium compound.*[15] With markings to show the differences relative to the Second Auxiliary Request Claims, claim 1 reads as follows:

> 1. An *organic light emitting device* comprising a heterostructure containing an emissive layer that produces luminescent emission when a voltage is applied across the heterostructure, wherein the emissive layer includes a molecule that is a phosphorescent *cyclometallated* organometallic iridium compound.

8. The claims in the Fourth Auxiliary Request Claims (**Reference 3e: Fourth Auxiliary Request Claims**) are directed to the subject matter of Group II from the Third Auxiliary Request Claims, but the Fourth Auxiliary Request Claims further narrow the *phosphorescent cyclometallated organometallic iridium compound* to *phosphorescent cyclometallated organometallic iridium compound with an aromatic ligand.*[16]

9. With markings to show the differences relative to the Third Auxiliary Request Claims, claim 1 reads as follows:

> 1. An *organic light emitting device* comprising a heterostructure containing an emissive layer that produces luminescent emission when a voltage is applied across the heterostructure, wherein the emissive layer includes a molecule that is a phosphorescent *cyclometallated* organometallic iridium compound *with an aromatic ligand*.

10. The claims in the Fifth Auxiliary Request Claims (**Reference 3f: Fifth Auxiliary Request Claims**) are directed to the subject matter of Group II from the Third (not Fourth) Auxiliary Request Claims, but the Fifth Auxiliary Request Claims add, to the heterostructure, *an exciton blocking layer.*

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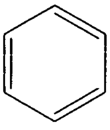
[15] A *cyclometallated* compound is a cyclic compound in which at least one of the ring members is a metal atom.

[16] An aromatic compound is a member of a class of compounds typified by benzene  .

11. With markings to show the differences relative to the Fourth Auxiliary Request Claims, claim 1 reads as follows:

> 1. An *organic light emitting device* comprising a heterostructure containing an emissive layer that produces luminescent emission when a voltage is applied across the heterostructure, wherein the emissive layer includes a molecule that is a phosphorescent *cyclometallated* organometallic iridium compound ~~with an aromatic ligand~~, and *further comprising an exciton blocking layer*.

12. An *exciton blocking layer*, i.e., the "barrier layer" in EP-238 (**Reference 1: EP-238, ¶18**), is a prior art structure. For example, as explained in Appendix B, EP-238 attributed its OLED efficiency to the OLED architecture and the *exciton blocking layer* (not the emissive molecule or dopant per se). (**Reference 1: EP-238, ¶25**) In fact, as explained in Appendix B, the best example from EP-238 uses substantially the same OLED structure as O'Brien's OLED structure, except for minor differences in layer thickness and the identity of the dopant.

13. Clearly, the claims from the Fifth Auxiliary Request Claims diverge (rather than converge) from those of the Fourth Auxiliary Request Claims and are therefore improper.

14. To be clear, UDC's EP-238 broadest surviving claim[17] reads as follows:

> 1. An ***organic light emitting device*** comprising a ***heterostructure*** containing an ***emissive layer*** that produces ***luminescent emission*** when a voltage is applied across the heterostructure, wherein the emissive layer includes a molecule that is ***a phosphorescent organometallic iridium compound.***

15. This constitutes UDC's broadest surviving claim, with emphasis drawn to an ***"organic light emitting device"*** (*OLED*) having an ***"emissive layer"*** that includes ***"a phosphorescent organometallic iridium compound."***

16. UDC also claims an *OLED* in which the ***"phosphorescent organometallic iridium compound"*** is "fac-tris-(2-phenylpyridine) iridium," or, for ease of identification, $\boldsymbol{Ir(ppy)_3}$.[18]

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[17] Claim 1, Second Auxiliary Request Claims (**Reference 3c**). References to claims in this document refer to the Second Auxiliary Request Claims (**Reference 3c**), unless otherwise noted.

III. EP-238's claims are not patentable.

17. The following sections demonstrate that UDC did not invent the following: an electroluminescent layer separate and apart from an OLED; an OLED or any component of an OLED; iridium or luminescent organometallic iridium compounds; phosphorescence; organometallic phosphorescent iridium devices; or an OLED containing phosphorescent compounds.

A. UDC did not invent an *electroluminescent layer* separate and apart from an OLED.

18. As noted above, UDC presented claims directed to an *electroluminescent layer* separate and apart from the OLED. EP-238's description does not describe an *electroluminescent layer* of Group I separate and apart from the *organic light emitting device* (OLED) of Group II. This observation is a "red flag" for anyone who examines a claim against the prior art. For complicated reasons, as more fully explained in Appendix C, the Opposition Division invalidated the claims directed to an *electroluminescent layer* from Group I in view of prior art that normally would not be available had the specification described the claimed embodiment.

19. For the reasons stated in Appendix C, the claims are invalid over the prior art cited therein, and an informed Board should affirm this decision by the Opposition Division. In other words, an informed Board should invalidate claims 1-15 (**Reference 3a: Original Claims**) and 1-12 (**Reference 3b: First Auxiliary Request Claims**) of Group I.

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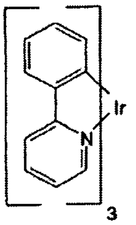
[18] Claim 3, Second Auxiliary Request Claims: "The organic light emitting device of claims 1 or 2 wherein the phosphorescent organometallic iridium compound is fac-tris(2-phenylpyridine) iridium, as denoted by the formula:"

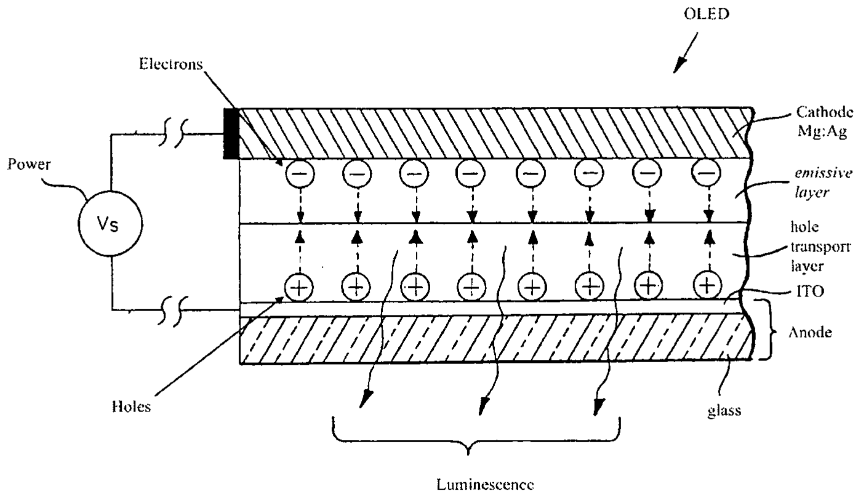


B. UDC did not invent OLEDs or any component of an OLED.

20. The following section presents evidence related to the broadest claims by UDC. As will be clear below, UDC was not the first to invent the following:

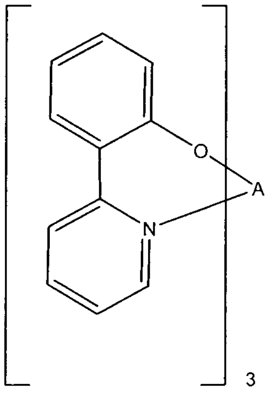
a. An OLED comprising a heterostructure containing an emissive layer that produces luminescent emission when a voltage is applied across the heterostructure;
b. An emissive layer that includes a molecule that is a phosphorescent organometallic iridium compound;
c. phosphorescent organometallic iridium compounds; or
d. phosphorescent organometallic compounds in OLEDs.

21. UDC was not the first to invent an *OLED*, let alone the architecture thereof. *OLEDs* have existed since the 1980s with the work of Kodak's C. W. Tang and S. A. VanSlyke, titled "Organic electroluminescent diodes," published in Applied Physics Letters in 1987 (**Reference 5: Tang I**); and "Electroluminescence of doped organic thin films" by C.W. Tang, S.A. VanSlyke, and C.H. Chen, published in the Journal of Applied Physics in 1989 (**Reference 6: Tang II [D15]**). Tang I-II describe an *OLED* comprising at least two thin organic layers (*an emissive layer* and a hole transport layer) separating an anode (ITO/glass) and cathode (Mg:Ag). Kodak obtained a patent titled "Organic Electroluminescent Devices Having Improved Power Conversion Efficiencies" under U.S. Patent No. 4,539,507 based on Tang and VanSlyke's work in 1985. (**Reference 7: Prior OLED Patent**). The Prior OLED Patent presents the OLED in the figure below.



When a power source (Vs) applies a greater potential to the anode than that of the cathode, electrons join molecules in the *emissive layer* and holes join molecules in the hole transport layer. The electrons and holes migrate towards each other and, when they combine, the result sometimes releases light, i.e., *luminescence*, a term that is generic for either phosphorescence or fluorescence. **(Reference 1: EP-238,¶5)**.

22. Tang's OLED comprises an *emissive layer* that comprises 8-hydroxyquinoline aluminum (AlQ$_3$),



AlQ$_3$,

a well-known luminescent emitter and described as "one of the most fluorescent and stable" molecules of its class and "has the ability to form smooth thin films." (**Reference 6: Tang II [D15], p. 3611**). AlQ$_3$ contains a metal atom (Al or aluminum) bonded to three ligands (Q or derived from 8-hydroxyquinoline). Thus, UDC was not the first to invent *OLEDs* having an *emissive layer*.

23. Tang's OLED comprises a layer called a hole transport layer, which comprises a diamine. **(Reference 6: Tang II [D15], p. 3611; Fig. 2)**.

24. Because Tang's OLED comprises a hole transport layer that is different than its emissive layer, Tang's OLED is a *heterostructure* as recited in UDC's claim 1 that is UDC's broadest surviving patent claim.

25. Thus, UDC could not have been the first to invent *an OLED comprising a heterostructure containing an emissive layer that produces luminescent emission when a voltage is applied across the heterostructure* as recited in claim 1.

C. UDC Did Not Invent Iridium or Luminescent Organometallic Iridium Compounds.

26. UDC's OLED invention claim an *emissive layer [that] includes a molecule that is a phosphorescent organometallic iridium compound* as recited in claim 1.

27. This section divides the above language into four (4) separate parts and examines each of the parts separately and as a whole.

a. Iridium;
b. Iridium compound;
c. $Ir(ppy)_3$; and
d. Emissive layer that includes an iridium compound.

1. <u>UDC did not invent *iridium or its use in an OLED.*</u>

28. The term *iridium* refers to an element (no. 77) from the periodic table.[19] Iridium is an element found between osmium and platinum in the periodic table of elements. *Iridium* is a natural substance found, e.g., as an alloy of *iridium* and another element called osmium.

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[19] **(Reference 8: Sharpe, p. 618)**. Iridium is the 77th element in the periodic table. It is a transition metal having an electron configuration of $Xe4f^{14}5d^{7}6s^{2}$. Osmium is the 76th element in the periodic table. It is a transition metal having an electron configuration of $Xe4f^{14}5d^{6}6s^{2}$. Being neighbors on the periodic table, iridium (I) has the same outer electronic structure as osmium (0), etc. In other words, some iridium compounds are isoelectronic with some osmium compounds and would be expected to share some chemistry and properties. Similarly, platinum is the

29. The sections below review the relevance of a 1984 patent on an iridium OLED and a 1991 publication showing the same *organometallic iridium compound* claimed by UDC to be *phosphorescent.* The sections below also show that (1) in the 1980s, a *phosphorescent organometallic* ***iridium*** *compound* was used in OLEDs; (2) in the 1980s *organometallic* ***platinum*** *compounds* were commonly used in OLEDs (see Appendix B); and (3) before EP-238 was filed, several *phosphorescent organometallic* ***osmium*** *compounds* were used in OLEDs.

2. **UDC did not invent an *iridium compound.***

30. The term *iridium compound* refers to a chemical substance having two or more elements which may or may not be the same but one of which is *iridium.* Many *iridium compounds* existed for a long time before EP-238 was filed. For instance, iridium fluoride, a compound of iridium and fluorine, was published in the 1980s. (**Reference 8: Sharpe, p. 641**). Two iridium chlorides were published before UDC's claim existed. (**Reference 8: Sharpe, p. 642-43**). Iridium carbonyl organometallic complexes existed in the 1980s. (**Reference 9: Mackay, p. 275**). Thus, UDC did not invent iridium compounds.

3. **UDC did not invent Ir(ppy)$_3$.**

31. The *iridium compound* cited in UDC's claim 3 (**Reference 3c: Second Auxiliary Request Claims**) is actually the very same Ir(ppy)$_3$ that was made and characterized by K. Dedeian in work published in 1991, titled "A New Synthetic Route to the Preparation of a Series of Strong Photoreducing Agents: *fac* Tris-Ortho-Metalated Complexes of Iridium(III) with Substituted 2-Phenylpyridines." (**Reference 10: Dedeian**). Thus, UDC did not even invent the Ir(ppy)$_3$ of claim 3.

32. Dedeian is not the first to publish making Ir(ppy)$_3$ (**see Reference 10: Dedeian, p 1686, citing footnotes 16, 22, & 35**), but Dedeian reports an improved method, in terms of yield, of synthesizing iridium compounds having multiple ligands having one carbon and one nitrogen bonding to the iridium atom. Examples of these compounds include Ir(ppy)$_3$ and the other compounds in Table 1 of Dedeian. (**Reference 10: Dedeian, p. 1686**). These compounds are phosphorescent (Table 1), and they have a low oxidation potential and work by transferring

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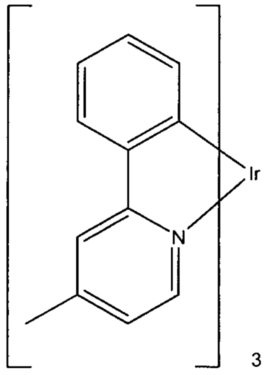
78th element in the periodic table and has an electron configuration $Xe4f^{14}5d^{9}6s^{1}$. Some forms of platinum are isoelectronic with some forms of iridium.

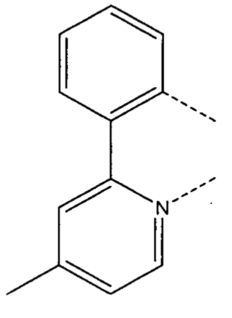
electron density from the metal (iridium) to the ligand (ppy) in a process called metal to ligand charge transfer or MLCT.[20] (**Reference 10: Dedeian, p. 1687, left side, first full paragraph**). At the end of Dedeian, the authors thank Nancy Keder for her assistance in determining the structure of Ir(4-Me-ppy)$_3$, the structure of which is below.



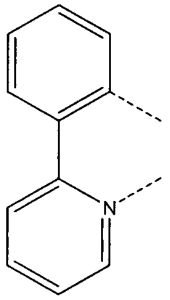
Ir(4-Me-ppy)$_3$.

(**Reference 10: Dedeian, p. 1687, left side, last full paragraph**).

33. Ir(4-Me-ppy)$_3$ differs from Ir(ppy)$_3$ on the ligands, where 4-Me-ppy has an extra methyl group (lower left-hand corner, straight line) where ppy does not.



4-Me-ppy



ppy .

34. Apparently, Nancy Keder is a crystal expert, and for Dedeian, she grew crystals of Ir(Me-ppy)$_3$ and told the authors of Dedeian how the atoms and molecules are arranged in space. Ir(Me-ppy)$_3$ is an analog of Ir(ppy)$_3$ and would show similar results as is evident from Table 1 of Dedeian. (**Reference 10: Dedeian, p. 1686**).

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[20] According to the IUPAC Gold Book, a metal to ligand charge transfer (MLCT) transition is an electronic transition of a metal complex that corresponds to excitation populating an electronic state in which considerable electron transfer from the metal to a ligand has occurred. (**Reference 11: IUPAC definition MLCT**).

35. Nancy Keder appears to have mentioned these results in P.I. Djurovich, et al., Inorg. Chem. 1992, 31, 3195-96. **(Reference 12: Djurovich)**. Djurovich shows that everyone appreciated that iridium with ligands like ppy work by the MLCT mechanism mentioned in Dedeian. **(Reference 12: Djurovich, p. 3195)**. Along these lines, Djurovich acknowledges that iridium is easily oxidized, from which we can infer, e.g., if one were to put on electricity (like in an OLED), then the electron will jump from the iridium atom to its ligand ppy. **(Reference 12: Djurovich, p. 3195)**.

36. By 1985, furthermore, $Ir(ppy)_3$ was described as "the first triply ortho-metalated ppy species to be characterized," and $Ir(ppy)_3$ "is one of the strongest transition-metal photoreductants thus far reported." **(Reference 45: King [D12], p. 1431, col. 1.)** So, $Ir(ppy)_3$ was a special molecule with unique properties attributed to the ppy ligand.

37. Moreover, the state of the art was well apprised of $Ir(ppy)_3$'s ground and luminescent excited states. For example, the authors of King **[D12]** studied $Ir(ppy)_3$'s penchant for phosphorescence in solvents like toluene. **(Reference 45: King [D12], *supra*. p. 1431, col. 2)**

38. In fact, when EP-238 noted $Ir(ppy)_3$ was phosphorescent, EP-238 compared its data to those in King **[D12]** *supra.* to confirm phosphorescence. **(Reference 1: EP-238, ¶28)**

4. **UDC did not invent an *emissive layer* that *includes* an *iridium compound.***

39. Another well-known *iridium compound* as of 1995 is IrQ'_3,[21] the structure of which is below.

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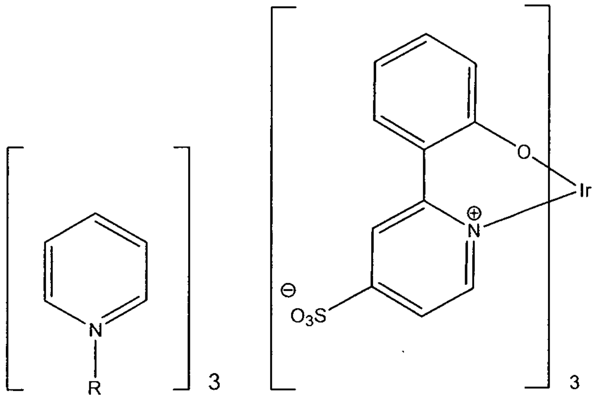
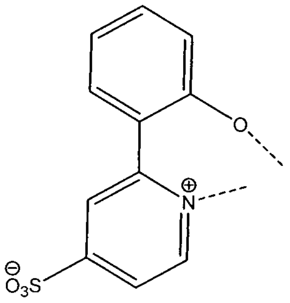
[21] Iridium pyridium 8-hydroxy-quinoline-4-sulfonate.



IrQ'$_3$

40. A Japanese patent, applied for in 1984, titled “Driving Method of EL Element,” under Japanese Patent No. (A)H 07-263145 (**Reference 13: JP-145 [S7-S8]**), shows IrQ’$_3$ on page 7, in the top-left-most structure in which M=Ir, Q’ = pyridium 8-hydroxyquinoline-4-sulfonate (**Reference 13: JP-145 [S7-S8]**).

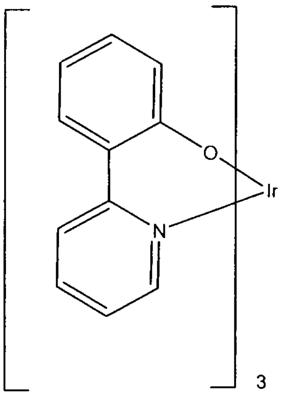


Q'

41. JP-145 also shows the use of IrQ’$_3$ in each luminescent layer of its OLED, e.g., Figure 2. (**Reference 13: JP-145 [S7-S8], p. 7; Figs. 2-3**).

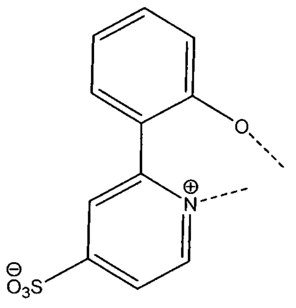
42. IrQ’$_3$ is also described in U.S. Patent no. 4,672,265 issued 1987 (**Reference 14: Prior Iridium OLED Patent**) as an example of an electroluminescent organic compound having high luminescent quantum efficiency. The electroluminescent organic compounds, including IrQ’$_3$ are inserted into a *heterostructure* having two or more layers (**Reference 14: Prior Iridium OLED Patent, col. 10**) between electrodes. (**Reference 14: Prior Iridium OLED Patent, col. 15, ll. 24-30; see also Figs. 2-4**).

43. IrQ’$_3$ is *a phosphorescent ... iridium compound* as recited in claim 1. IrQ’$_3$ is closely related in structure to IrQ$_3$.

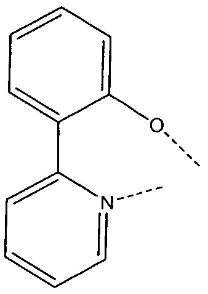


IrQ_3

IrQ_3 and IrQ'_3 are analogs, in which IrQ'_3 has a sulfonate group where IrQ_3 has hydrogen on its ligand.



Q'



Q

(See the structures above, on the lower ring of each, at 8 o'clock. Notice the $^{-}O_3S$ on Q' v. nothing on Q.) This close structural similarity raises a presumption and expectation that both IrQ'_3 and IrQ_3 possess similar properties.

44. One of the inventors of EP-238 admitted that IrQ_3 is *phosphorescent*. "Organic Light-emitting Devices Based on Phosphorescent Hosts and Dyes" by R.C. Kwong, S. Lamansky, and M. E. Thompson, published in *Advanced Materials* in 2000, refers to the phosphorescence yield of IrQ_3 (**Reference 15: Kwong [S9]**). Since IrQ_3 has a close structural relationship to IrQ'_3, and IrQ_3 is *phosphorescent*, there is no reason to believe that IrQ'_3 is not *phosphorescent*. In any case, IrQ'_3 and IrQ_3 possess similar luminescent properties, which are of course corroborated by JP-145's use of IrQ'_3 and Kwong's use of IrQ_3 in OLED.

45. The term *phosphorescent* means "exhibiting phosphorescence" and is an adjective that describes the *iridium compound* "exhibiting phosphorescence." UDC's patent claims are for a phosphorescent compound – i.e., an inherent trait of the compound itself – rather than phosphorescent emission.

46. AlQ_3, IrQ_3, and IrQ'_3 are members of a class of molecules called oxinoids. For example, Tang also substituted the metal aluminum for other metals, such as the transition metal zinc, in the Prior OLED Patent. (**Reference 7: Prior OLED Patent, col. 9, ll. 14-17**). The metal (Al in AlQ_3, etc.) is bound to an oxygen atom (O) and a nitrogen atom (N) atom of a group of atoms (8-hydroxyquinoline) called a ligand. Close examination of AlQ_3 reveals three such ligands (each being derived from 8-hydroxyquinoline) in which the metal is bound to an oxygen atom (O) and a nitrogen atom (N). This particular bonding is called an oxinoid structure. The oxinoid structure, by 1991, was recognized as a generic class of compounds being highly desirable for OLEDs. See "Blue Emitting Internal Junction Organic Electroluminescent Device (II)," U.S. Pat. No. 5,150,006 (**Reference 16: Prior Oxinoid Patent**). Furthermore, the oxinoid structure was used reversibly as a dopant or as a host. (**Reference 16: Prior Oxinoid Patent, col. 18, ll. 12-28**). There is a good reason to use members of this art recognized class of emissive molecules.

D. UDC's did not invent phosphorescence.

47. The International Union of Pure and Applied Chemistry ("IUPAC") defines the noun *phosphorescence* as follows: "From a phenomenological point of view, the term has been used to describe long-lived luminescence. In mechanistic photochemistry, the term designates luminescence involving change in spin multiplicity, typically from triplet to singlet or vice versa. The luminescence from a quartet state to a doublet state is also phosphorescence" (**Reference 17: IUPAC-phosphorescence**). As a result, a *phosphorescent iridium compound* is an *iridium compound* capable of exhibiting long-lived luminescence involving a change in spin multiplicity, e.g., from triplet to singlet. As shown above, phosphorescent iridium compounds include IrQ'_3, IrQ_3, and $Ir(ppy)_3$, each of which was "invented" before UDC's patent filing.

48. UDC's claim 1 recites *a phosphorescent ... iridium compound*, not that the emission from the OLED is phosphorescent. In fact, UDC's claim 1 recites that the "emissive layer … produces luminescent emission," not *phosphorescent emission*. Luminescent emission is a term that

embraces any type of emission (phosphorescent or fluorescent). The term "phosphorescent … iridium compound" in claim 1 must refer to an inherent property of the recited iridium compound, otherwise the phrase "emissive layer … produces luminescent emission" would be superfluous.

49. UDC's claim 1 does not require a threshold amount of ***luminescent emission*** from its OLEDs. Nor does UDC's claim 1 require that the source of the emission is the "phosphorescent … iridium compound."

E. UDC did not invent organometallic phosphorescent iridium devices.

50. During the opposition, UDC raised issues about what is and what is not *organometallic* to shield its claims from invalidating prior art. A summary of the dispute is in Appendix D.

51. The term *organometallic* also describes the *iridium compound.* EP-238 teaches that "The term 'organometallic' is as generally understood by one of ordinary skill, as given, for example, in "Inorganic Chemistry" (2nd edition) by Gary L. Miessler and Donald A. Tarr, Prentice-Hall (1998)…" (**Reference 1: EP-238, p. 7, ¶22**) (citing **Reference 18: Miessler [D4]**). By using the terms "generally" and "for example," UDC was shopping for a broad rather than a strict literal definition.

52. IUPAC defines *organometallic* as follows: "Classically compounds having bonds between one or more metal atoms and one or more carbon atoms of an organyl group." (**Reference 19: IUPAC – Organometallic**).

53. An "organyl group," according to IUPAC is "Any organic substituent group, regardless of functional type, having one free valence at a carbon atom, e.g. CH_3CH_2–, $ClCH_2$–, $CH_3C(=O)$– , 4-pyridylmethyl. Organyl is also used in conjunction with other terms, as in organylthio- (e.g. MeS–) and organyloxy." (**Reference 20: IUPAC – Organyl**).

54. Because organyl groups can be any organic substituent group, regardless of functional type, clearly, IUPAC does not exclude, from the definitions of organyl groups, cyanides (-CN).

55. Furthermore, IUPAC concerns a "classical" definition of *organometallic*, which has metal bond to a carbon of an organyl group.

56. Other non-classical definitions exist and denote bonding of any organyl radical (organyloxy, organylamino, etc.) to a metal. For example, Miessler, cited in EP-238 for a

general understanding of *organometallic*, acknowledges that the strict classical definition is not followed in practice and that many organic ligands bound to a metal are included in the ambit of *organometallic.* (**Reference 18: Miessler [D4]**). One definition, e.g., is "consisting of a metal combined with an organic radical, used particularly for a compound in which the metal is linked directly to a carbon atom." (**Reference 21: Dorland's Med. Dictionary - organometallic**). Clearly, the Q ligands in IrQ'$_3$ are organic radicals combined with a metal Ir, and thus, IrQ'$_3$ is *organometallic.* In fact, several of the inventors have used the non-classical definition of *organometallic* in their writings. For example, in Baldo et al., Pure Appl. Chern., Vol. 71, No. 11, 2095-2106, 1999 (**Reference 22: Baldo I [D25]**) (Baldo I), at the foot of page 2098, there is a section entitled "Organometallic Phosphors." In the first full paragraph on page 2099 in the fourth line of that paragraph, Balbo states that "Application of organometallic complexes in OLEDs was demonstrated [2] by Ma et al doping several osmium complexes in poly (N-vinyl carbazole." The reference to "Ma et al." is a direct reference to Y. Ma, H. Zhang, J. Shen, C. Che, Electroluminescence from triplet metal-ligand charge-transfer excited state of transition metal complexes, Synthetic Metals 94:245-48 (1998) (**Reference 23: Ma [D1]**). Because some of the authors of Balbo I (**Reference 22: Baldo I [D25]**) are co-inventors of the instant application, they clearly considered the term "organometallic" to have a broad definition. Ma should be admitted prior art as to EP-238.

57. This is not an isolated reference. In another reference co-authored by one of the inventors, namely, "Organic Light Emitting Diodes", M. E. Thompson et al., Comprehensive Organometallic Chemistry Ill, Volume 12, 101 (2007) (**Reference 24: Thompson [D29]**), the co-inventors refer to the "organometallic" complexes formed from the transition metals (osmium and ruthenium) and ligands bonding thereto via two nitrogen atoms (N^N) as "organometallic complexes used…."(**Reference 24: Thompson [D29], page 173, Fig. 42** (top row, showing Os or Ru bonded to N^N ligand but characterized as "organometallic")).

58. And this use of a non-classical definition embraces such species as the oxinoid structure (N^O) of AlQ$_3$ and IrQ$_3$'. U.S. Patent No. 5,486,406, Green-emitting organometallic complexes for use in light emitting devices, in the name of S.Q. Shi issued January 23, 1996 (**Reference 25: Organometallic Oxinoids Patent [S4]**) refers to numerous oxinoids (N^O) as "organometallic," and in particular the Organometallic Oxinoids Patent identifies AlQ$_3$ (an oxinoid N^O) and other metal complexes based on Q (8-hydroxyquinoline and its derivates) as "organometallic."

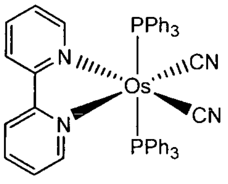
(**Reference 25: Organometallic Oxinoids Patent [S4], col. 1, ll. 41-50**). In fact, the Organometallic Oxinoids Patent identifies the Prior Oxinoid Patent by its number. (**Reference 25: Organometallic Oxinoids Patent [S4], col. 1, l. 44**). Similarly, A. Curioni, et al., Alq_3 *ab initio* calculations of its structural and electronic properties in neutral and charged states, Chem. Phys. Lett. 294 (1998) 263-271 (**Reference 26: Curioni [S3]**) relates to OLEDs, and at line 5 of the first column it states that Alq_3 "is a textbook organometallic complex." Clearly, UDC's narrow definition is totally improper.

59. For the above reasons, UDC was not the first to invent an *emissive layer* that *includes a molecule that is a phosphorescent organometallic iridium compound* as recited in claim 1. Each of JP-145 (**Reference 13: JP-145 [S7-S8]**) and the '265 patent (**Reference 14: Prior Iridium OLED Patent**) destroys novelty of claim 1.

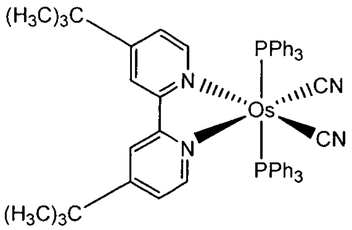
60. EP-238 discloses only one example of an iridium compound, i.e., $Ir(ppy)_3$. Based on this one example, UDC's broadest claims recite any *phosphorescent organometallic iridium compound.* If UDC claims that one *phosphorescent organometallic iridium compound* is enough to support a claim to both all *phosphorescent organometallic iridium compounds* and all *phosphorescent organometallic osmium compounds*, then JP-145's or the '265 patent's disclosure of a single *phosphorescent organometallic iridium compound* (IrQ'_3) should render non-inventive all other *phosphorescent organometallic iridium compounds.*

F. UDC did not invent an OLED containing phosphorescent compounds.

61. Before UDC's EP patent was filed, Yuguang Ma described using four *phosphorescent organometallic* **osmium** *compounds* in an OLED (**Reference 23: Ma [D1],** ***see also*** **Fig. 1 for the OLED structure**).



1



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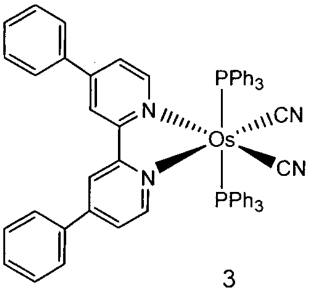

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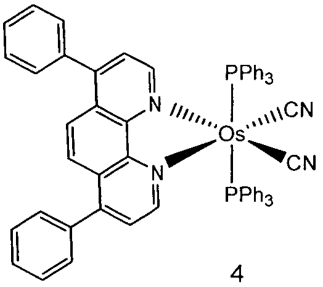

4

Each osmium compound (**1**)-(**4**) contains an osmium atom (Os) bonded to at least three different organic ligands chosen from bipyridine and its derivatives (see compounds (**1**)-(**3**) leftmost group), 4,7-diphenyl-1,10-phenanthroline (see compound (**4**) leftmost group), triphenyl phosphine (see PPh_3 in compounds (**1**)-(**4**) at the 12 & 6 o'clock groups), and cyanide (see CN in compounds (**1**)-(**4**) 2 & 4 o'clock groups). Even under the classical definition, CN is an organyl group bonded to a metal osmium (Os) thus making each of the compounds *organometallic osmium compounds*. Moreover, as mentioned above inventors of EP-238 admitted that Ma's complexes are "organometallic." (**Reference 24: Thompson [D29], p. 173, Fig. 42**).

62. Ma fabricated an OLED having a heterostructure comprising, between an aluminum cathode and an ITO anode, two layers. The hole transport layer (HTL) comprises PVK[22] and the emissive *organometallic osmium compounds* (**1**)-(**4**). The electron transport layer (ETL) comprises PBD.[23]

63. Ma determined that the osmium compounds are *phosphorescent*. In other words, Ma's emissive *organometallic osmium compounds* (**1**)-(**4**) are emissive *phosphorescent organometallic osmium compounds* per claim 1.

64. Thus, an informed Board should find that Ma destroys novelty of claims 1 & 16 (**Reference 3a: Original Claims**) and claim 1. (**Reference 3b: First Auxiliary Request**

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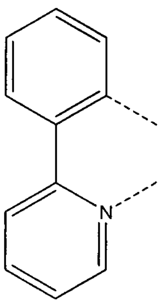
[22] PVK is poly(N-vinyl carbazole).

[23] PBD is 2-(4-biphenyl)-5-(4-tert-butyl-phenyl)-1,3,4-oxadiazole.

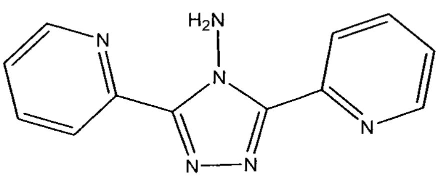
Claims). Of course the reasons here are independent and apart from those offered by the Opposition Division. See Appendix C-E.

65. Moreover, Ma teaches to make a simple substitution of any of its four *phosphorescent organometallic* **osmium** *compounds* (**1**)-(**4**) for a *phosphorescent organometallic **iridium** compound* of G. Di Marco, M. Lanza, and M. Pieruccini, A luminescent Iridium(III) cyclometallated Complex Immobilized in a Polymeric Matrix as a Solid-State Oxygen Sensor, Adv. Mater. 8(7):576-79 (1996). (**Reference 27: DiMarco [D27]**). In particular, Ma states that the particular organometallic compounds of DiMarco "provide possibility to design the high-efficiency EL device by using … triplet excited-state materials." (**Reference 23: Ma [D1], p. 245, col. 1**). Ma attributes the efficiency to the well-known use of a "strong interaction between metal centre and the ligands, [because] the transition metal complexes (such as Ru, Os, Ir) exhibit a metal-ligand charge-transfer (MLCT) excited state which shows the triplet nature." (**Reference 23: Ma [D1], p. 245, col. 1**).[24] Ma claims to describe the "first observation of EL from triplet MLCT excited states of transition metal complexes." (**Reference 23: Ma [D1], p. 245, col. 2**).

66. DiMarco's *phosphorescent organometallic **iridium** compound* is Ir(ppy)$_2$(dpt-NH$_2$)(PF$_6$). DiMarco's *phosphorescent organometallic **iridium** compound* has two ligands called ppy, which bonds from one of its carbons to the *iridium* and the nitrogen to the *iridium*, and one ligand called dpt-NH$_2$, which ligands are below.



ppy



dpt-NH$_2$

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[24] Recall, Dedeian (**Reference 10: Dedeian**) and Djurovich (**Reference 12: Djurovich**) taught that iridium works by a MLTC, which is noted in Ma's (**Reference 23: Ma [D1]**) citation of Ir(ppy)$_2$X of DiMarco (**Reference 27: DiMarco [D27]**) *vide infa.*

67. DiMarco's *phosphorescent organometallic **iridium** compound* is 20 times more luminescent than other related compounds of ruthenium tris-(2,2'-bipyridine). (**Reference 27: DiMarco [D27], p. 579**).

68. Substituting DiMarco's *phosphorescent organometallic **iridium** compound* for one of Ma's *phosphorescent organometallic* **osmium** *compounds* would result in an OLED of claim 1 in UDC's EP-238.

69. It is true that the Opposition Division denied the inventive step challenge against surviving claim 1. The specific arguments are in Appendix F. An informed Board, nevertheless, should find that UDC's claims are non-inventive.

70. At the outset, it is worth noting that EP-238 is not a pioneering invention. All the component parts were known, and the inventors of EP-238 merely combined them. Ma set forth the theory for *phosphorescent* OLEDs containing a *phosphorescent organometallic **osmium** compound.* The parties agreed that Ma is the closest prior art.

71. Ma clearly shows an *OLED* containing four different *phosphorescent organometallic **osmium** compounds* having a quantum efficiency of 0.1%. (**Reference 23: Ma [D1], p. 247**). The differences between Ma and claim 1 include a simple substitution of Ma's *phosphorescent organometallic **osmium** compound* for claim 1's *phosphorescent organometallic **iridium** compound.*

72. Upon making the simple substitution, the result (technical effect) would a low yield device. As noted in Appendix B, EP-238 tested one example that produced a highly emissive OLED, but most of the examples did not. In particular, as noted in EP-238's Figure 2, several embodiments had a quantum efficiency of 0.05-0.2%, which is comparable to that of Ma (**Reference 23: Ma [D1]**), i.e., 0.1%. The objective technical problem solved upon making the simple substitution is not, as urged by UDC, finding a high efficiency electroluminescent emitter. If it were, then UDC's invention would not have solved that problem, because many OLEDs comprising Ir(ppy)$_3$ produced low quantum efficiencies. As explained in Appendix B, the high efficiency is attributed to the OLED architecture, and as explained in O'Brien (**Reference 28: O'Brien [D19], p. 444**) and emphasized in EP-238 (**Reference 1: EP-238, ¶25**), the barrier layer (not the emissive molecule or dopant *per se*) is essential to the high efficiency devices. In fact, as explained in Appendix B, the best example from EP-238 uses substantially the same OLED structure as O'Brien's OLED structure, except for minor differences in layer thickness

and the identity of the dopant. Clearly, the inventors of EP-238 simply substituted O'Brien's dopant for Ir(ppy)$_3$ in O'Brien's OLED structure.

73. So, contrary to UDC's argument, the objective technical problem solved upon making the simple substitution is finding an alternative to Ma's *phosphorescent organometallic* ***osmium*** *compound.*

74. One would clearly choose claim 1's *phosphorescent organometallic* ***iridium*** *compound,* because Ma (**Reference 23: Ma [D1]**) directs the reader to consider DiMarco (**Reference 27: DiMarco [D27]**) for identifying improved and/or alternative emitters comprising iridium. Specifically, Ma (**Reference 23: Ma [D1]**) teaches that "some organometallic complexes exhibit stronger triplet state emission [citation to DiMarco (**Reference 27: DiMarco [D27]**)]... which provides a possibility to design the high efficiency EL device by using these triplet excited state materials." (**Reference 23: Ma [D1], p. 246, col. 1**). DiMarco (**Reference 27: DiMarco [D27]**) teaches an iridium (III) complex, which is isoelectronic to the osmium (II) complex, having the same ligand (ppy) as recited in Ir(ppy)$_3$, the only working Example of EP-238.

75. Furthermore, after Ma's use of *phosphorescent organometallic* ***osmium*** *compound,* but before EP-238's invention, O'Brien, as candidly admitted in EP-238, made a *phosphorescent* OLED containing a *phosphorescent* ***platinum*** *compound.* Between osmium and platinum on the period table of elements is iridium, an obvious next logical choice for a metal center.

76. It would have been non-inventive to simply substitute one of Ma's exemplified osmium (II) complexes 1-4 with the iridium (III) complex of DiMarco in the hopes of finding an alternative to Ma's *phosphorescent organometallic* ***osmium*** *compound.*

77. Notwithstanding the suggestion to try DiMarco's iridium (III) complex in Ma's system, UDC argued that Ma "discourages one ... from moving toward the invention," because Ma's data show that "high PL efficiency produces a 'rather low' EL efficiency." (**Reference 29: UDC's Observations of March 13, 2008**). This ignores that fact that four osmium compounds were successfully tested by Ma, that the efficiency is comparable to some examples in EP-238 which used Ir(ppy)$_3$, and that Ma unequivocally concluded that "[o]ur research results suggest that the materials with high triplet state PL efficiency can be used as the emitting layer of EL devices, which extends the material's range and provides a new approach to improve the EL efficiency."

78. In any case, the experimental basis for EP-238 includes the testing of one compound, an iridium compound called $Ir(ppy)_3$, and the specification mentions one class of osmium compounds, which EP-238 describes as isoelectronic (having the same outer electronic structure) to the Ir analogs. (**Reference 1: EP-238, ¶ 32, p. 10, l. 20**). If EP-238's experiment with an iridium compound would have suggested (to them) to use any osmium compound, then it seems perfectly natural for one of ordinary skilled in the art having knowledge of Ma's OLED containing one of Ma's four osmium compounds to look to iridium compounds, especially when the one true pioneer, Ma, directed everyone to use a specific organometallic phosphorescent iridium compound comprising ppy.

79. EP-238's Original Claims 1 & 16 embrace a tremendous amount of subject matter, and the *iridium compounds* and *osmium compounds* are not confined to a structure, stability, luminescence, emission lifetime, or color of emission. The facts and law do not support a claim to such a broad scope of protection, especially since EP-238's contribution is a simple substitution of known components. See Appendix G for a discussion on the description issues raised during the opposition.

80. Moreover, DiMarco's *phosphorescent organometallic **iridium** compound* Ir has 2 ppy ligands, while claim 3 of the EP-238 recites $Ir(ppy)_3$ having three ligands ppy. This difference is meaningless. Any supplier of Ir could make and deliver Ir with 2 or 3 ppy. See, e.g., Dedeian (**Reference 10: Dedeian**) and A.P. Wilde, J. Phys. Chem., vol. 95, pp. 629-34 (1991) (**Reference 30: Wilde**). In fact, EP-238 admitted that $Ir(ppy)_3$ was a known *phosphorescent organometallic iridium compound.* (**Reference 1: EP-238, ¶28)(citing Reference 45: King [D12] to confirm that the *phosphorescent organometallic iridium compound* is indeed *phosphorescent.***)

81. The idea of adding another ppy is not grounds of any claim of invention of an Ir emitter that is different than DiMarco and much less ownership of all iridium compounds in all OLEDs.

82. Anyone reading Ma and DiMarco could make the simple substitution proposed by Ma and result in what UDC claimed. Simple substitutions that are directed by previous research with expected results are not inventive.

IV. References

1. European Patent No. 1 449 238, "Very High Efficiency Organic Light Emitting Devices Based on Electrophosphorescence."
2. European Patent Office, Interlocutory Decision in Opposition Proceedings, Patent No. 1 449 238, January 13, 2012.
3. a. Original Claims; b. Frist Auxiliary Request Claims; c. Second Auxiliary Request Claims; d. Third Auxiliary Request Claims; e. Fourth Auxiliary Request Claims, & f. Fifth Auxiliary Request Claims European Patent No. 1 449 238, dated September 29, 2011 (a-c) and dated December 18, 2012 (d-f).
4. Notices of Appeal, European Patent No. 1 449 238, filed by: The Trustees of Princeton University (Mar. 9, 2012), Sumitomo Chemical Co., Ltd. (Mar. 21, 2012), BASF SE (Mar. 15, 2012), and Merck Patent GmbH (Mar. 6, 2012).
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38. UDC Grounds for Appeal in European Patent No. 1 449 238 of May 11, 2012.
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40. BASF Grounds for Appeal in European Patent No. 1 449 238 of May 23, 2012.
41. Sumitomo Grounds for Appeal in European Patent No. 1 449 238 of May 23, 2012.
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V. Introduction to Appendices

The preceding Review of EP-238 discussed the merits of the patent's claims in view of the arguments raised before an EPO Board of Appeal, as it considers whether to revoke EP-238 in its entirety. On the basis of the record considered by the EPO Opposition Division, along with other evidence, the Review finds that the breadth of EP-238's claims, as originally granted, is unjustified and that the patent should be revoked. Set forth below are seven appendices; the appendices discuss essential background information related to the arguments considered in the Review.

Appendix A discusses the content of EP-238 as originally granted, including the experimentation that formed the basis of the patent application. **Appendix B** summarizes the EP-238 opposition proceedings before the EPO to date, especially the Opposition Division's decision to invalidate some of the patent's original claims. **Appendix C** discusses the Opposition Division's reasons for invalidating certain of the original claims directed to an electroluminescent layer in view of prior art. **Appendix D** addresses the key controversy surrounding the use of the term "organometallic" and the Opposition Division's decision not to address this controversy. **Appendix E** discusses the Opposition Division's reasons for invalidating certain claims, other than those directed to an electroluminescent layer, and certain key evidence that was not considered in the Opposition Division's decision. **Appendix F** explains the challenge to EP-238 on the basis of inventive step, and explains arguments that EP-238's inventors only made a simple substitution based on others' work. **Appendix G** addresses sufficiency of disclosure arguments, and provides an analysis of contradictory positions taken by UDC in defending EP-238.

A. Appendix A: Content of EP-238

1. European Patent No. 1 449 238 ("EP-238") is derived from and claims priority benefit to European Application no. 00932308.0, filed May 11, 2000, as PCT/US2000/012946, which is derived from U.S. Application no. 09/311,126, filed May 13, 1999. The "Proprietors" of EP-238 are both The Trustees of Princeton University & The University of Southern California, who, on information and belief, have licensed their rights in EP-238 to Universal Display Corp. or UDC.

1. Subject matter of EP-238.

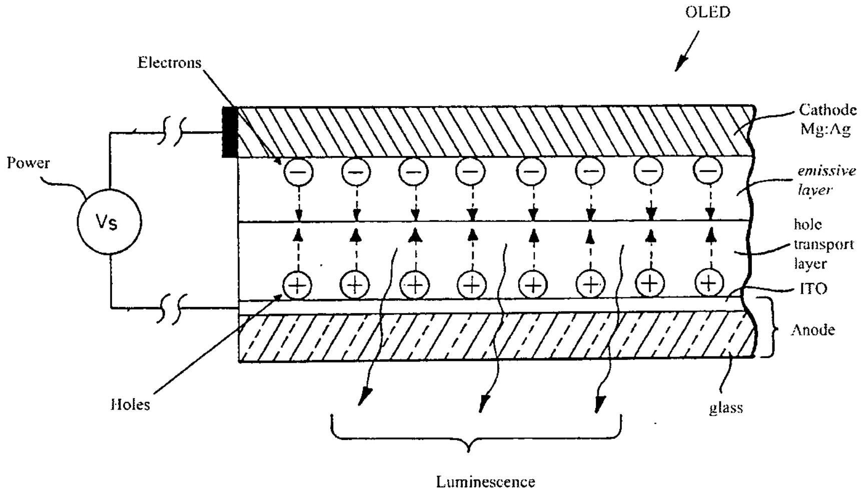
2. EP-238's description is directed an organic light emitting device comprising a *heterostructure* containing an *emissive layer* that produces *luminescent emission* when a voltage is applied across the *heterostructure*, wherein the emissive layer includes a molecule that is a *phosphorescent organometallic iridium compound* or a *phosphorescent organometallic osmium compound.* (**Reference 1: EP-238, ¶13**).

3. *Organic light emitting devices*, or "*OLEDs*," as relevant here, include two or more organic layers between a cathode and an electrode (a *heterostructure*) in which one of the layers contains an organic molecule that can be made to emit light by applying a voltage across the device. (**Reference 1: EP-238, ¶2**). The layer that emits light is called the *emissive layer*. The *emissive layer* contains a molecule that is either a *phosphorescent organometallic iridium compound* or a *phosphorescent organometallic osmium compound.*

4. EP-238 candidly admits that *OLEDs* have existed since the 1980s with the work of Kodak's C. W. Tang and S. A. VanSlyke, titled "Organic electroluminescent diodes," published in Applied Physics Letters in 1987 (**Reference 5**: **Tang I-** C.W. Tang et al., Appl. Phys. Lett. 1987, 51, 913); and "Electroluminescence of doped organic thin films" by Tang, VanSlyke, and Chen, published in the Journal of Applied Physics in 1989 (**Reference 6**: **Tang II [D15]**). Tang describes an *OLED* comprising at least two thin organic layers (*an emissive layer* and a hole transport layer) separating an anode (ITO/glass) and cathode (Mg:Ag). Although not mentioned in EP-238, Kodak obtained a patent titled "Organic Electroluminescent Devices Having Improved Power Conversion Efficiencies" under U.S. Patent No. 4,539,507 based on Tang and VanSlyke's work in 1985 (**Reference 7: Prior OLED Patent**).

5. Tang's Prior OLED Patent presents the OLED having a *heterostructure* in the figure below.

Fig. A-1: Tang's Prior art OLED Structure



Here the *emissive layer* is the electron transport layer. Although not shown here, in some embodiments, the *emissive layer* is the hole transport layer, and in other embodiments, the *emissive layer* is separate from both the electron transport layer (adjacent to the cathode) and the hole transport layer (adjacent to the anode), i.e., a double *heterostructure OLED*. Other embodiments are possible as will be discussed herein.

6. When a power source (Vs) applies a greater potential to the anode than that of the cathode, electrons join molecules in the *emissive layer* and holes join molecules in the hole transport layer. The electrons and holes migrate towards each other, and when they combine, the result sometimes releases light, i.e., *luminescence*, a term that is generic for either phosphorescence or fluorescence. **(Reference 1: EP-238, ¶5)**.

7. Electrons and holes pairs on a single molecule form what is called an "exciton." **(Reference 1: EP-238, ¶5)**. Without going into the quantum mechanics, there are four equally-probable possible-states for an electron-hole pair, one singlet (S^*) and three triplet states (T^*).[25] A singlet (S^*) may recombine ($S^* \rightarrow S$) to emit light, i.e., *luminescence*, in a process sometimes called fluorescence. The three triplet states (T^*) may recombine ($T^* \rightarrow S$) but they tend not to emit much light, because they tend to have highly inefficient *luminescence*, or highly inefficient

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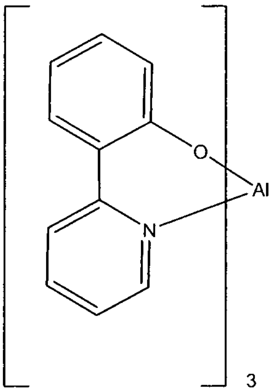
[25] The * means an excited state. For example, S* and T* refer to the excited state in which the electron-hole pair are localized on a molecule. S refers to the ground state of the molecule after hole and electron combine. $S^* \rightarrow S$ and $T^* \rightarrow S$ refer to relaxation from a singlet (S*) and triplet (T*) state, respectively.

phosphorescence, for reasons related to quantum properties of matter, which will not be addressed here.

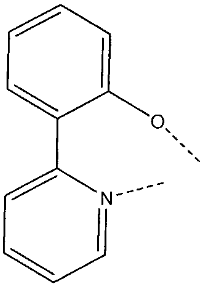
8. There were, before the time of EP-238, known exceptions, as EP-238 identifies and used one particular *organometallic iridium compound* emitter that EP-238 admitted was a known *phosphorescent organometallic iridium compound.* **(Reference 1: EP-238, ¶28) (citing Reference 45: King [D12] to confirm that the *phosphorescent organometallic iridium compound* is indeed *phosphorescent.*)**

9. For example, Tang's OLED comprises an *emissive layer* that comprises 8-hydroxyquinoline aluminum (AlQ$_3$), whose structure is shown below,



AlQ$_3$.

AlQ$_3$ is a well-known luminescent emitter and described as "one of the most fluorescent and stable" molecules of its class and "has the ability to form smooth thin films." (**Reference 6: Tang II [D15], p. 3611**). AlQ$_3$ contains a metal atom (Al or aluminum) bonded to three ligands (Q or derived from 8-hydroxyquinoline) as evident by the subscript 3 in the drawing of AlQ$_3$. A single ligand Q is illustrated as follows:



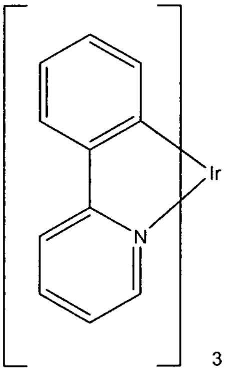
Q-a ligand .

The literature attributes Tang's OLED's emission primarily to a singlet (S^*) recombining ($S^* \rightarrow S$) to *luminescence* in a process sometimes called fluorescence.

10. Moving away from fluorescence, EP-238 implies that its inventors are the first entity to produce phosphorescent OLEDs, i.e., obtaining an OLED that takes advantage of the three triplet exciton states (T^*) which recombine ($T^* \rightarrow S$) having at least some *luminescence* that is phosphorescence. In this regard, they selected a particular molecule for use in the *emissive layer*.

2. EP-238 Tested One Molecule in Several Heterostructures.

11. The only molecule tested is a *fac-tris*-(2-phenylpyridine) iridium," or, for ease of identification, Ir(ppy)$_3$, the structure of which is as follows:[26]



Ir(ppy)$_3$.

Ir(ppy)$_3$ has one iridium atom and three ligands of 2-phenylpyridine, which is called ppy, the structure of which is as follows:

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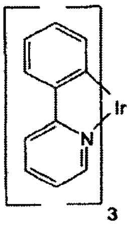
[26] The stereochemistry is not shown. Claim 3, Second Auxiliary Request Claims, reads as follows: "The organic light emitting device of claims 1 or 2 wherein the phosphorescent organometallic iridium compound is fac-tris(2-phenylpyridine) iridium, as denoted by the formula:"



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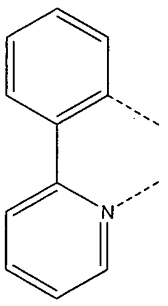
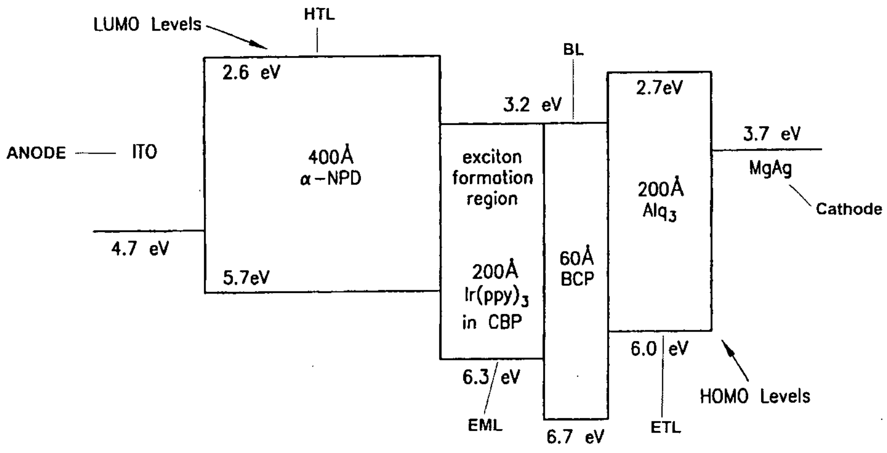


ppy .

UDC added $Ir(ppy)_3$ to an existing OLED heterostructure shown below:

Figure A-2: Figure 1-Annotated from EP-238



12. In this figure, going from left to right, the anode (ITO or indium tin oxide) serves to remove electrons (adds holes) when the current flows. The "HTL" or hole transport layer is 400Å[27] thick and contains a molecule known as α-NPD.[28] α-NPD serves to transport holes towards the emitting layer, i.e., "EML." The EML, as noted above, is 200Å thick and contains $Ir(ppy)_3$ and another molecule known as CBP.[29] As noted above, the EML is the *emissive layer*, i.e., the layer that generates light.[30]

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[27] Å is 1/10,000,000,000 of a meter or 0.1 nm.

[28] 4,4'-bis(N-(1-naphthyl)-N-phenyl-amino] biphenyl, i.e., an amine hole transporter.

[29] 4,4'-N,N'-dicarbazole-biphenyl, which is referred to as a "host material" in EP-238. (**Reference 1: EP-238, ¶15**).

[30] Nomenclature note: When a host material is used in the emissive layer, the "dopant" (here, $Ir(ppy)_3$) is the material that determines the emitted color of the OLED. Cf. (**Reference 1: EP-238, ¶13**). The host usually makes up a large part of the *emissive layer*. EP-238 states the relative amount of the host (CBP) and dopant ($Ir(ppy)_3$) in the passages related to Figure 2, where 1%, 6%, 12%, & 100% [$Ir(ppy)_3$: CBP] are exemplified.

13. In this figure, going from right to left, the cathode (Mg:Ag), when the current flows, injects electrons into the "ETL," i.e., the electron transport layer. The ETL is 200Å thick and contains AlQ_3[31] to help transport electrons towards the *emissive layer.* The "BL" or barrier layer (also called an *exciton blocking layer*)[32] is 60Å thick and is placed to increase the efficiency of the emissive layer by ensuring that the recombination of electrons and holes occurs in occurs in the *emission layer.*[33]

3. $Ir(ppy)_3$ does not improve the emission properties of each and every embodiment of the OLED heterostructures tested.

14. In EP-238's Figure 2, UDC varied the composition of the *emissive layer* by increasing the relative amounts of the [$Ir(ppy)_3$: CBP] (dopant : host). 1%, 6%, 12%, & 100% [$Ir(ppy)_3$: CBP] are exemplified. Only the 6% [$Ir(ppy)_3$: CBP] produced a quantum efficiency of about 8%, i.e., the percentage maximum of the theoretical yield of emission. (**Reference 1: EP-238, Fig. 2**). The 1% & 12% [$Ir(ppy)_3$: CBP] produced quantum yields of about 5% and about 3%, respectively. (**Reference 1: EP-238, ¶26**). The 100% $Ir(ppy)_3$ embodiments produced a quantum efficiency of about 0.8%. Clearly, not all embodiments produce strong emission. (**Reference 1: EP-238, ¶27**).

15. In fact, EP-238 reports a second device in which the emissive layer is 6% [$Ir(ppy)_3$: CBP] and there is no barrier layer, and a third device in which the emissive layer is 6% [$Ir(ppy)_3$:AlQ_3] having a BCP barrier layer. Both devices produced very similar low quantum efficiencies. Clearly, not all embodiments produced strong emission, and $Ir(ppy)_3$ is not itself sufficient to increase quantum yields in every OLED heterostructure device. (**Reference 1: EP-238, ¶27**). These data show that the quantum efficiency is a function of the OLED architecture, the presence of a barrier layer, and the identity of the host.

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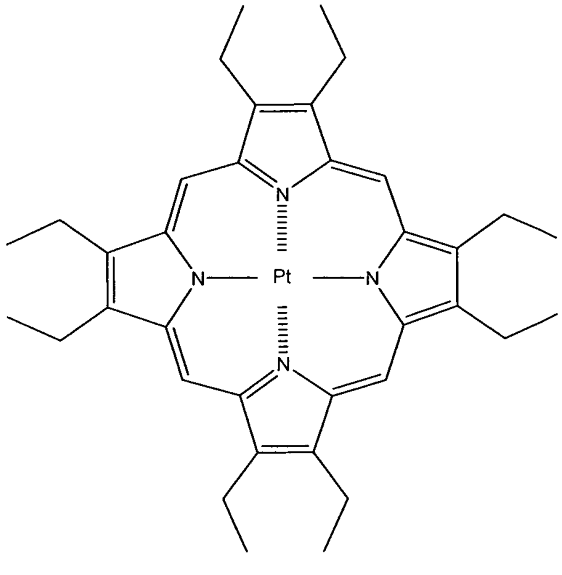
[31] AlQ_3 is the same as Alq_3 and refers to the same molecule that Tang II (**Reference 6: Tang II [D15]**) used.

[32] Reference 1: EP-238, ¶18.

[33] This OLED is an example of a double heterostructure, because the *emissive layer* is separate from both the electron transport layer and the hole transport layer.

4. EP-238 requires the use of a specific *OLED heterostructure* in order to achieve high quantum efficiencies.

16. EP-238 candidly credits another for developing a particular OLED heterostructure and admits that a "barrier layer ... was necessary to ... maintain high efficiencies." (**Reference 1: EP-238, ¶25**). The prior art OLED heterostructure is described in D.F. O'Brien, et al., "Improved energy transfer in electrophosphorescent devices," Appl. Phys. Let. 1999, 74, 442-444. (**Reference 28: O'Brien [D19]**). In particular, O'Brien describes the same OLED heterostructure that was used in Example 2 of EP-238, except for minor variations in the thickness of the individual layers and for the particular dopant. While O'Brien describes using a platinum compound, namely, PtOEP,[34]



PtOEP ,

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[34] PtOEP is 2,3,7,8,12,13,17,18-octaethyl-21H,23H-porphine platinum (II). Members of the porphine family, including platinum complexes of porphine, have been used as hole transport materials since at least 1991. (**Reference 16: Prior Oxinoids Patent, col. 28**). For example, the Prior Oxinoids Patent incorporates by reference U.S. Patent No. 3,935,031, Photovoltaic cell with enhanced power output, issued to Adler in 1976, and is technically part of the Prior Oxinoids Patent's description. (**Reference 16: Prior Oxinoids Patent, col. 28**). The '031 patent teaches 2,3,7,8,12,13,17,18-octaethyl-21H,23H-porphine zinc (zinc octethyl porphyrin or ZnOEP) in column 5, table II, second "Porphyrinic Compound" and claim 6, at col. 10, lines 59-60. The Prior Oxinoids Patent unequivocally states that any porphyrin from the '031 patent may be used, i.e., including ZnOEP, and that one should use the "particularly" preferred metal center platinum (**Reference 16: Prior Oxinoids Patent, col. 29, line 26**), which substitution would necessarily result in PtOEP.

EP-238 describes using $Ir(ppy)_3$. The differences between the OLED heterostructures in O'Brien and EP-238 are summarized in Table A1 below.

Table A1: Differences in Heterostructures between O'Brien and EP-238

OLED Component	**Ref. A-1: O'Brien (Best example)**	**Ref. 1: EP-238 (Best example)**
Cathode	1000Å 25:1 Mg:Ag with 500Å Ag cap	Same
ETL	250Å Alq_3	Same but 200Å thick
BL	80Å BCP	Same but 60Å thick
EML	6% PtOEP dopant in CBP host 250Å thick	6% $Ir(ppy)_3$ dopant in CBP host 200Å thick
HTL	α-NPD 450Å thick	Same but 400Å thick
Anode	ITO (unspecified thickness)	Same (unspecified thickness)
Quantum efficiency	~5.6%	~8%

Clearly, to modify O'Brien's example in a way to reach the embodiment of Example 2 in EP-238 would require a simple substitution of O'Brien's PtOEP with EP-238's $Ir(ppy)_3$.

17. EP-238 even admits that O'Brien's OLED works by the same mechanism as its embodiment in Example 2 of EP-238. (**Reference 1: EP-238**, ¶26) ("Thus, the energy transfer pathway in $Ir(ppy)_3$:CBP is likely to be similar to that in PtOEP:Alq_3 (Baldo, et al., Nature, 1998, 395, 151[35]; O'Brien, 1999, op. cit.) i.e. via short range Dexter transfer of triplets from the host.").

18. While the quantum efficiency of O'Brien's OLED is about 5.6%, that of EP-238's best example is about 8%. Yet, without a barrier layer (BL), the quantum efficiencies of both O'Brien's OLED and EP-238's OLED are clearly below 1%, as apparent in Figure 1 of O'Brien,

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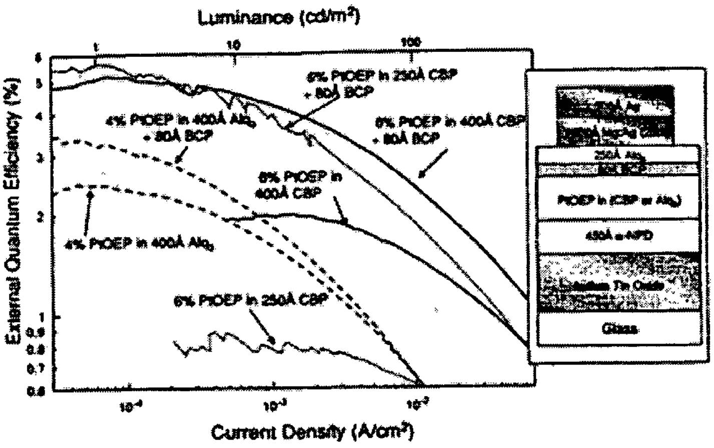
[35] Baldo, et al., Nature, 1998, 395, 151 (**Reference 31: Baldo II [D2]**) is the foundation to O'Brien (**Reference 28: O'Brien [D19]**). In fact, in the opening paragraph, O'Brien indicates that they improved Baldo's quantum yield from about 4% to 5.6% "by altering the host material and the device structure...." (**Reference 28: O'Brien [D19], p. 442, col. 1**).

reproduced below. However, a thicker emissive layer resulted in about 2% efficiency. No analogous data (emission v. thickness) appear in EP-238.

Figure A-3: O'Brien, p. 443; Fig. 1.



Clearly, the barrier layer (BL) is required to achieve high quantum-efficiency and the statement in EP-238 about the need for a barrier layer (BL) is accurate.

5. EP-238 requires the use of a specific *host-dopant* pair in order to achieve high quantum efficiencies.

19. O'Brien and EP-238 also substituted the host from the best example (CBP) with Alq_3. In O'Brien, substituting the CBP host and lowering the amount of PtOEP from 6% to 4% resulted in quantum efficiencies between 2-3.5% for the embodiments having 4% PtOEP in 400Å Alq_3 with and without a barrier layer. (**Reference 28: O'Brien [D19], p. 443, Fig. 1**). As noted above, however, [$Ir(ppy)_3$: Alq_3] with a barrier layer (BL) produced very low quantum-efficiencies (below 1%). (**Reference 1: EP-238, Fig. 2**). Thus, O'Brien, and EP-238 by implication, attribute the higher quantum-efficiencies not only to the OLED structure but also to the identity of the host material.

6. EP-238 speculates that other molecules will work as well as $Ir(ppy)_3$.

20. EP-238 further states the its "emissive molecules" are not limited to its sole example, $Ir(ppy)_3$ and that one could use various analogs of $Ir(ppy)_3$ to obtain "desirable properties" such as color. (**Reference 1: EP-238, ¶31**).

21. EP-238 further states its emissive molecules could also include "[o]rganometallic compounds of osmium." (**Reference 1: EP-238, ¶32**). EP-238 shows several examples which are "isoelectronic with the Ir analogs." (**Reference 1: EP-238, ¶33**).

22. None of these emissive molecules was tested.

7. The remaining ingredients of the OLED are conventional.

23. The remainder of the materials are conventional, i.e., in the sense that others have already developed these materials.

B. Appendix B: Overview of the Opposition Procedure in EP-238.

1. EP-238's date of publication and mention of the grant of the patent occurred on November 2, 2006. Shortly thereafter, as allowed under European law, three separate parties opposed the grant of EP-238.[36] What follows below is a statement about the steps followed in the opposition. The relevant substance of the proceeding is discussed elsewhere.

2. Before reading further, it is helpful to review the claims as outlined above in Section II. In short, the claims are grouped into two sets, namely, Group I is directed to an *electroluminescent layer*, and Group II is directed to *an organic light emitting device (OLED)* including the *electroluminescent layer* from Group I.

3. On March 9, 2007, Sumitomo, the first Opponent, filed an opposition on several grounds, the most relevant of which are as follows:

   a. EP-238's claims directed to an *emissive layer* from Group I are invalid under 54 EPC, because they are not novel over the prior art Baldo III (**Reference 32: Sumitomo Opposition, pp. 4-5**);

   b. EP-238's claims directed to an *emissive layer* and an *OLED* from Groups I-II are invalid under 54 & 56 EPC, because they are lack novelty or inventive step the prior art D1-Ma in view of D9-DiMarco (**Reference 32: Sumitomo Opposition, pp. 6-7**); and

   c. EP-238's claims from Group I-II are not supported by an adequate disclosure under 83 EPC, because the specification contains one example but the claims cover numerous embodiments (**Reference 32: Sumitomo Opposition, pp. 10**).

4. On July 24, 2007, Merck, the second Opponent, filed an opposition in the German language (**Reference 33: Merck Opposition**), and on August 6, 2007, BASF, the third Opponent, filed an opposition in the German language. (**Reference 34: BASF Opposition**).[37]

5. On March 13, 2008, UDC replied to the notices of opposition (**Reference 29: UDC's Observations**).

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[36] Proper notices of opposition were filed by three parties, namely, Sumitomo Company Limited (Opponent I, filed March 9, 2007) (**Reference 32: Sumitomo Opposition**), Merck Patent GmbH (Opponent II, filed July 24, 2007) (**Reference 33: Merck Opposition**), and BASF Aktiengesellschaft (Opponent III, filed August 1, 2007). (**Reference 34: BASF Opposition**).

[37] This paper does not fully consider the non-English language documents. Although Merck and BASF participated in the Opposition, limited mention about the papers they filed is made herein.

6. On July 8, 2011, the parties were summoned to attend oral proceedings on November 3, 2011. (**Reference 35: Summons**). In its preliminary opinion, in the annex of the summons, the Opposition division stated the following:

a. EP-238's claims directed to an *emissive layer* from Group I are invalid under 54 EPC, because they are not novel over the prior art Baldo III (**Reference 35: Summons, Annex, ¶¶2.1, 2.3**);

b. EP-238's claims 1 & 16 are invalid as anticipated by the osmium complex disclosed in D1-Ma, which should be regarded as "organometallic" (**Reference 35: Summons, Annex, ¶2.3**);

c. EP-238's claims do not suffer from insufficiency of disclosure issues (**Reference 35: Summons, Annex, ¶2.2**); and

d. Inventive step will be discussed at the oral proceedings (**Reference 35: Summons, Annex, ¶2.4**).

7. On September 29, 2011, UDC provided a submission in preparation of oral proceeding. UDC maintained that EP-238's original claims are patentable. (**Reference 36: UDC Submission**). UDC also provided four sets of auxiliary claims, i.e., a first, second, third and fourth fallback positions if the Opposition Division were to find claims from an earlier claim set invalid. (**Reference 3b-e: First, Second, Third, & Fourth Auxiliary Request Claims**).[38] The claims in the First Auxiliary Request Claims are directed to the subject matter of Groups I-II, but these claims do not embrace the *phosphorescent organometallic osmium compound.* The claims in the Second Auxiliary Request Claims are directed to the subject matter of Group II from the First Auxiliary Request Claims. The claims in the Third Auxiliary Request Claims are the subject matter of Group II from the Second Auxiliary Request Claims, but these claims narrow the *phosphorescent organometallic iridium compound* to *phosphorescent cyclometallated organometallic iridium compound.*[39] The claims in the Fourth Auxiliary Request Claims are the subject matter of Group II from the Third Auxiliary Request Claims, but these claims narrow the

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[38] The Third and Fourth Auxiliary Request Claims were replaced with their corresponding versions filed December 18, 2012, and on the same date a Fifth Auxiliary Request Claims, respectively, were added. References 3d-f are the Third, Fourth, and Fifth Auxiliary Request Claims filed December 18, 2012.

[39] A *cyclometallated* compound is a cyclic compound in which at least one of the ring members is a metal atom. Claim 1 of the Third Auxiliary Request Claims of December 18, 2012, matches claim 1 of the Third Auxiliary Request Claims filed September 29, 2011.

phosphorescent cyclometallated organometallic iridium compound to *phosphorescent cyclometallated organometallic iridium compound* *with an aromatic ligand*.[40]

8. On September 30, 2011, Sumitomo provided a submission to Opposition Division and included a request to invalidate claims based on lack of novelty over JP-145 (**Reference 13: JP-145 [S7-S8]**) as translated. (**Reference 37: Sumitomo Submission, p. 3**). JP-145 was not presented earlier, because Sumitomo just learned of this document.

9. November 3, 2011, an oral hearing was made.

10. On January 13, 2012, the Opposition Division selected to maintain the patent in amended form. (**Reference 2: EP-238 Interlocutory Decision**). In short, and for the reasons explained in Appendix C, the Opposition Division invalidated all of the claims from Group I (directed to an *electroluminescent layer*) and forced UDC to amend (and to renumber) claims from Group II to delete reference to the *osmium compound.* Claim 16, e.g., is effectively changed as follows:

> ~~16~~ 1. An organic light emitting device comprising a heterostructure containing an *emissive layer* that produces *luminescent emission* when a voltage is applied across the heterostructure, wherein the emissive layer includes a molecule that is a *phosphorescent organometallic iridium compound* ~~or a phosphorescent organometallic osmium compound~~.

The Opposition Division Decision is appealable to an independent Board of Appeals, and here notices of appeal (**Reference 4: EP-238 Notices of Appeal**) and grounds for appeal have been made by all parties. See T0544/12-3.4.03. In short, UDC appeals to maintain the patent with its original claims from Groups I-II. (**Reference 38: UDC Grounds for Appeal**). Each Opponent appeals to revoke the patent or to maintain the patent in more narrowly amended form. (**References 39-41: Merck, BASF, & Sumitomo, respectively, Grounds for Appeal**).

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[40] An aromatic compound is a member of a class of compounds typified by benzene. Claim 1 of the Fourth Auxiliary Request Claims of December 18, 2012, matches claim 1 of the Fourth Auxiliary Request Claims filed September 29, 2011. Also, UDC filed a Fifth Auxiliary Request Claims on December 18, 2012. Relative to the Fourth Auxiliary Request Claims, the Fifth **deletes** the requirement for *with an aromatic ligand* but adds the admitted prior art element *an exciton blocking layer*. Clearly, the Fifth Auxiliary Request Claims of December 18, 2012 (**Reference 3f: Fifth Auxiliary Request Claims**) improperly diverges (rather than converges) from the Fourth Auxiliary Request Claims.

C. Appendix C: Opposition Division's Reasons for Invalidating claims to Group I of EP-238.

1. The Opposition Division invalidated each claim from Group I (claims 1-15 of EP-238) over M.A. Baldo et al., Very high-efficiency green organic light-emitting devices based on electrophosphorescence, Applied Phys. Let. 75:4-6 (1999) (**Reference 42: Baldo III [D6]**). In Europe, one cannot claim what was old, i.e., prior art, e.g., a printed publication, in existence at the time just before the day the European application was filed. Art. 54.[41] But determining what is and is not prior art is not always easy.

2. Sometimes the European application is based on an earlier filed application, e.g., in the United States. These U.S. applications are called priority documents, and they can act like a shield against the prior art, because the European application will be treated as if it were effectively filed on the same date as the earlier filed priority application, as long as "certain conditions" *vide infra* are met. Before understanding the certain conditions, it is helpful to provide more context.

3. In this case, the European application of EP-238 was filed May 11, 2000, and its U.S. priority application no. 09/311,126 was filed May 13, 1999 (**Reference 43: UDC U.S. priority application**). Thus, an informed reviewer must determine whether to compare the claims against the prior art in existence as of May 13, 1999, or as of May 11, 2000. Sometimes the question is unimportant.[42] But here the question is very important, because Baldo III published in the intervening period of the U.S. and EP filing dates, and Baldo III is essentially a written description of the core contents of EP-238. In Table form, here is the scenario.

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[41] Art. 54 (1) An invention shall be considered to be new if it does not form part of the state of the art. (2) The state of the art shall be held to comprise everything made available to the public by means of a written or oral description, by use, or in any other way, before the date of filing of the European patent application.

[42] Such is the case here for the claims in Group II, because no opponent raised this issue as to claims from this group.

Table C-1: Intervening prior art as to EP-238's claims from Group I

May 13, 1999	July 5, 1999	May 11, 2000
U.S. Priority document filed	Baldo III Publishes ("prior art" on this date)	EP-238's application filed
Possible shield against Baldo III if "certain conditions" are met	Basically EP-238's description, invalidates unshielded claims	Claims to Group I, directed to an *emissive layer* separate and apart from an *OLED* first presented

If the "certain conditions" are met, Baldo III is not prior art, because the U.S. priority document shields the claims. But if the conditions are not, Baldo III is prior art as to the claims for which the condition is not met.

4. The relevant condition here is that a European application claiming priority of an earlier application must relate to the "same invention" as the earlier application (Art. 88 EPC).[43] The "same invention" exists for a claim in a European patent "only if the person skilled in the art can derive the subject-matter of the claim directly and unambiguously, using common general knowledge, from the previous [US] application as a whole." Otherwise, the application is not entitled to the prior art shielding effect of the earlier filed application.

5. The Sumitomo opposition urged that the claims from Group I are not entitled to the shielding priority date, because they are directed to an *electroluminescent layer* separate and apart from an *OLED.* **(Reference 32: Sumitomo Opposition, p. 4**). According to the argument, the U.S. priority document does not directly and unambiguously disclose such an embodiment as an invention. Thus, these claims are vulnerable over prior art in existence as of May 11, 2000, the date the EP application was filed. (**Reference 32: Sumitomo Opposition, p. 4**).

6. UDC generally disagreed and cited passages from the specification of EP-238 in an attempt to show *implicit* support for an *emissive layer* separate and apart from an OLED. (**Reference 36: UDC Submission, pp. 16-17**). For example, UDC pointed to part of claim 1 of the U.S. priority document reading: *In an organic light emitting device comprising a*

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[43] Art. 88 (4) If certain elements of the invention for which priority is claimed do not appear among the claims formulated in the previous application, priority may nonetheless be granted, provided that the documents of the previous application as a whole specifically disclose such elements.

heterostructure for producing luminescence, an emissive layer…." (**Reference 36: UDC Submission, p. 16**).[44]

7. In any case, the Opposition Division agreed with the Sumitomo and decided that the claims from Group I should be denied the shielding benefit of the priority document and examined against the prior art before the EP application was actually filed, i.e., May 11, 2000. (**Reference 2: Interlocutory Decision, pp. 9-10**).

8. Claims 1-15, based on the Opposition Division's decision not to shield the claim from the prior art, are invalidated by at least Baldo III and two other references,[45] each of which discloses the claimed *electroluminescent layer*. (**Reference 2: Interlocutory Decision, pp. 10-11**).

9. As a result of the findings, the Opposition Division thereafter considered UDC's First Auxiliary Request Claims.[46] Claims 1-12 (First Auxiliary Request Claims) are the same as claims 1-15 (Original Claims) except claims 1-12 (First Auxiliary Request Claims) do not recite the *phosphorescent organometallic osmium compound.* Since Baldo III is essentially the same as EP-238, the Opposition Division also invalidated claims 1-12 (First Auxiliary Request Claims) for the same reasons offered for invalidating the Original Claims.

10. Claims 1-12 (Second Auxiliary Request Claims) do not claim an *emissive layer* separate and apart from an *OLED.* These claims do not present the issues raised with the *emissive layer.* This is why, as a result of these grounds for opposition, Original Claims 1-15 & First Auxiliary Request Claims 1-12, i.e., Group I, were invalidated.

11. UDC appealed this decision. (**Reference 38: UDC Grounds For Appeal, pp. 6-9**).

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[44] In actuality, the citation to claim1 is misleading. The remainder of claim 1 further defines the structure of the *emissive layer*, allowing it to be selected from *an emissive molecule* from the class of *phosphorescent organometallic complexes*. (**Reference 43: UDC Priority Application, claim 1**). Clearly, the class of all *phosphorescent organometallic complexes* recited in the priority document is much broader than the subclass of *phosphorescent organometallic iridium compound[s] or a phosphorescent organometallic osmium compound[s]* recited in original claim 1 of EP-238. And, as noted herein, before the time EP-238 was filed, *phosphorescent organometallic complexes* of platinum, osmium, and iridium were used in OLED.

[45] European Patent Application no. 1 013 740, published June 28, 2000 (**Reference 44: EP740 [D17]**), and Baldo I (**Reference 22: Baldo I [D25]**) were cited but appear to be cumulative of Baldo III (**Reference 42: Baldo III [D6]**) for the present purposes. Neither is considered in detail below.

[46] The Opposition Division will search for a suitable amended *claim set* from UDC's auxiliary request claims that avoids this issue. See UDC's Second Auxiliary Request Claims.

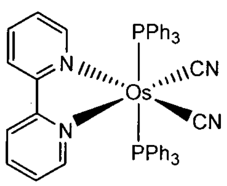
D. Appendix D: Novelty destroying reference of claims from Group II.

1. As noted above, for unexplained reasons, Opposition Division avoided heart of the issues for claim 16 (original) by ignoring the references that destroy the novelty of claim 16. Claim 16 recites *organometallic,* which has multiple meanings in different contexts. Under a broader meaning, Sumitomo's cited prior art would invalidate claim 16. Under the narrower meaning, UDC would be allowed to argue otherwise. The issue is whether to apply UDC's narrow meaning to the term *organometallic* to limit the scope of *organometallic iridium* or *osmium* compounds of claim 16 to those having a direct metal-carbon bond, in which the metal is *iridium* or *osmium* and the bonded carbon is part of an organic ligand.

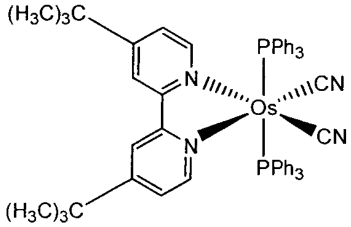
2. The Sumitomo opposition urged that the subject-matter of claim 16 is not new over several documents, including the following:

   a. Yuguang Ma, Houyu Zhang, Jiacong Shen & Chiming Che, Synthetic Metals 94 (1998), 245-248 (**Reference 23: Ma [D1]**);
   b. G DiMarco, M Lanza, M Pieruccini and S Campagna, Advanced Materials 1996, 8 (7), 576-580 (**Reference 27: DiMarco [D27]**); and
   c. JP (A) 7-263145A as translated (**Reference 13: JP-145 [S7-S8]**).

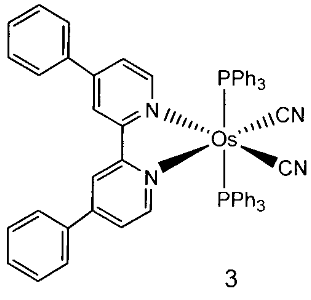
3. For example, Ma (**Reference 23: Ma [D1]**) JP-145 discloses an OLED having the recited *heterostructure* and an emissive layer comprising an osmium (II) complex chosen from the following structures 1-4:



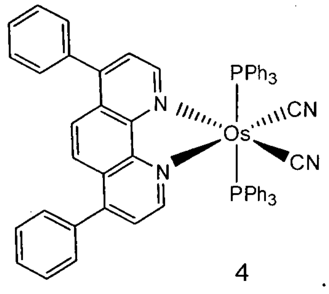
1



2



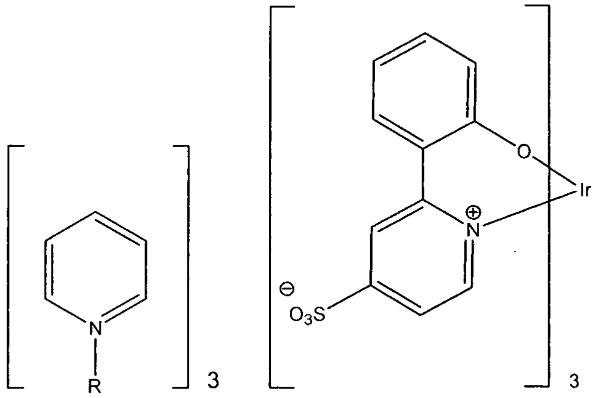
3



4 .

(**Reference 32: Sumitomo Opposition, pp. 5-6**). Notice the osmium (Os) is bonded to a carbon (CN group). Thus, under the ordinary definition of *organometallic*, Ma (**Reference 23: Ma [D1]**) would destroy novelty and invalidate the claimed subject matter.

4. Similarly, JP-145 (**Reference 13: JP-145 [S7-S8]**) discloses an OLED having the recited *heterostructure* and an emissive layer comprising an *iridium compound.*



IrQ'$_3$

(**Reference 13: JP-145 [S7-S8], p. 7**). Notice that the iridium (Ir) is bonded to non-carbon atoms (an oxinoid N^O) but an organic ligand. Thus, under the ordinary definition of *organometallic*, JP-145 (**Reference 13: JP-145 [S7-S8]**) would destroy novelty and invalidate the claimed subject matter.

5. As noted above, to avoid this issue, UDC alleged that the term "***organometallic***" before *iridium* and *osmium* limits the scope of ***organometallic*** *iridium* or *osmium* compounds to those having a direct metal-carbon bond, in which the metal is *iridium* or *osmium* and the bonded carbon is part of *an organic ligand.* (**Reference 29: UDC's Observations, p. 8**). Here, the UDC referred to the specification of EP-238, which reads as follows:

> The term "organometallic" is as generally understood by one of ordinary skill, as given, for example, in "Inorganic Chemistry" (2nd edition) by Gary L. Miessler and Donald A. Tarr, Prentice-Hall (1998).

(**Reference 29: UDC's Observations, pp. 7-8** (citing EP-238,[47] ¶22, p. 7, ll. 23-24)). They thereafter selected a passage from the cited book to support their position, (**Reference 29:**

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[47] (**Reference 1: EP-238, ¶22**).

UDC's Observations, p. 8), and submitted an expert declaration. Ma's compounds 1-4 have a metal-carbon bond to a CN group, but, under UDC's definition, a CN group is not an organic ligand. Thus, UDC argued that Ma (**Reference 23: Ma [D1]**) does not destroy novelty. (UDC never responded to **Reference 13: JP-145 [S7-S8]**).

6. Sumitomo responded that Miessler itself states "Organic chemistry, the chemistry of compounds containing metal-carbon bonds..." (**Reference 18: Miessler [D4], p. 422**) does not limit itself to organic carbon ligands. Additionally, the normal meaning of the words would apply unless given a special meaning by an explicit definition. The cited passage is not a definition, because it merely states what is "generally" understood and is Miessler (**Reference 18: Miessler [D4]**) is just an "example" of a meaning, not the meaning. Along these lines, Sumitomo cited counter evidence of the meaning of *organometallic*, including some admissions by the inventors of EP-238 and other inorganic chemistry textbooks. Sumitomo discredited the declaration as an opinion of an "organometallic chemist[]" rather than one of skill in OLED. Thus, the term "organometallic" should be given the meaning ascribed normally to it in the OLED art.

E. Appendix E: The Opposition Division's reasons for invalidating claims 16 (Original claims) and claim 13 (First Auxiliary Request).

1. Claim 16 was also invalidated, because of the same three references that destroyed novelty of claim 1 (Original Claims) in Appendix C. The Opposition Division also found that claim 16 is invalidated by at least Baldo III (**Reference 42: Baldo III [D6]**), European Patent EP 1 013 740, Electroluminescent material, electroluminescent element and color conversion filter, published June 28, 2000 (**Reference 44: EP740 [D17]**), and Baldo I (**Reference 22: Baldo I [D25]**), each of which discloses the claimed *OLED.* (**Reference 2: Interlocutory Decision, pp. 10-11**).

2. UDC appealed this decision, because each of these references is not prior art as to the claims from Group II. (**Reference 38: UDC Grounds for Appeal, p. 10**). According to UDC, the priority shielding benefit of the claims from Group II was not challenged, and the claims from Group II should have been accorded priority benefit, thereby removing Baldo III (**Reference 42: Baldo III [D6]**), EP740 (**Reference 44: EP740 [D17]**), and Baldo I (**Reference 22: Baldo I [D25]**) from the prior art.

3. This finding also prompted the Opposition Division to find that claim 13 (First Auxiliary Request Claims) is also invalid for the same reasons. The Opposition Division then turned to claims 1-12 from the Second Auxiliary Request Claims.

4. We do not need to address this decision, because these claims are invalid for other reasons. Interestingly, the Opposition Division did not repeat its preliminary finding that EP-238's claims 1 & 16 are invalid as not novel over the osmium complexes disclosed in Ma (**Reference 23: Ma [D1]**), which should be regarded as "organometallic." (**Reference 35: Summons to Oral Proceedings, Annex, ¶2.3**). Moreover, the Opposition Division did not consider JP-145 (**Reference 13: JP-145 [S7-S8]**) and its use of an iridium compound in an OLED, because the Opposition Division found that JP-145 is not *prima facie* relevant. These concepts are discussed in detail in elsewhere.

F. Appendix F: Inventive step.

1. The Opposition Division denied the inventive step challenge to the claims from Group II directed to OLEDs containing the *phosphorescent organometallic iridium compound.*

2. Sumitomo argued that Ma (**Reference 23: Ma [D1]**) is the closest prior art to claim 1 (Second Auxiliary Request Claims) directed to an *OLED* containing the *phosphorescent organometallic iridium compound* having a quantum efficiency of 0.1%. The differences between Ma and claim 1 include a simple substitution of Ma's *phosphorescent organometallic* ***osmium*** *compound* for claim 1's *phosphorescent organometallic* ***iridium*** *compound.*

3. Sumitomo argued that upon making the simple substitution, the result (technical effect) could be inferred from EP-238's examples. (**Reference 41: Sumitomo Grounds for Appeal, ¶2.8**). Only one example of an emissive molecule (Ir(ppy)$_3$) was tested in several heterostructures. As noted in Appendix B, one heterostructure produced a highly emissive OLED, but most of the other heterostructures did not. In particular, as noted in EP-238's Figure 2, several heterostructures had a quantum efficiency of 0.05-0.2%, which is comparable to that of Ma (**Reference 23: Ma [D1]**), i.e., 0.1%. For this reason, Sumitomo argued that the objective technical problem solved upon making the simple substitution is finding an alternative to Ma's *phosphorescent organometallic* ***osmium*** *compound.* (**Reference 41: Sumitomo Grounds for Appeal,¶2.8.5**).

4. Sumitomo argued that one would choose claim 1's *phosphorescent organometallic* ***iridium*** *compound*, because Ma directs the reader to consider DiMarco (**Reference 27: DiMarco [D27]**) for identifying improved emitters comprising iridium. (**Reference 32: Sumitomo Opposition, p. 6**). Specifically, Ma teaches that "some organometallic complexes exhibit stronger triplet state emission [citation to DiMarco]... which provides a possibility to design the high efficiency EL device by using these triplet excited state materials." (**Reference 23: Ma [D1], p. 246, col. 1**). DiMarco (**Reference 27: DiMarco [D27]**) teaches an iridium (III) complex, which is isoelectronic to the osmium (II) complex, having the same ligand (ppy) as recited in Ir(ppy)$_3$, the only working Example of EP-238. (**Reference 32: Sumitomo Opposition, pp. 6-7**). In effect, Sumitomo argues that it would have been non-inventive to simply substitute one of its exemplified osmium (II) complexes 1-4 with the iridium (III) complex of DiMarco in the hopes of finding an alternative to Ma's *phosphorescent organometallic* ***osmium*** *compound.*

5. UDC agrees that Ma is the closest prior art and that the difference is a substitution of Ma's *phosphorescent organometallic* ***osmium*** *compound* with claim 1's *phosphorescent organometallic* ***iridium*** *compound.* (**Reference 29: UDC's Observations, p. 21-23**). UDC, however, argues that one of its devices achieved 8% quantum efficiency using Ir(ppy)$_3$, and that the *iridium* makes it possible to achieve phosphorescence in lieu of fluorescence.[48] The technical problem solved, according to UDC, is finding a high efficiency electroluminescent emitter. (**Reference 29: UDC's Observations, p. 22**)

6. Notwithstanding the suggestion to try DiMarco's iridium (III) complex in Ma's system, UDC argued that Ma "discourages one ... from moving toward the invention," because Ma's data show that "high PL efficiency produces a 'rather low' EL efficiency." (**Reference 29: UDC's Observations, p. 21**). According to UDC, DiMarco's complexes, for example, are from different technical fields and concerned with photoluminescence rather than electroluminescence, and reading DiMarco, the skilled artisan would select a ruthenium complex, i.e., the other of two options, rather than DiMarco's iridium complex.

7. The Opposition Division sided with UDC. (**Reference 2: Interlocutory Decision, ¶7.2**). According to the Opposition Division, DiMarco regards phosphorescence and is from a different field than Ma, which regards electroluminescence.

8. Sumitomo appealed this decision to the Board. (**Reference 41: Sumitomo Grounds for Appeal, §2.8**).

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[48] The jargon used is that a singlet exciton undergoes "intersystem crossing" (ISC) between to a triplet exciton (S* →T*), where the emission upon recombination of an electron-hole pair is phosphorescence (T* →S). The claims do not require ISC. As noted above, each version of UDC's claims recite that the emission is *luminescent emission*, not **phosphorescent** *emission*. Furthermore, Ma (**Reference 23: Ma [D1]**) noted that both osmium and iridium compounds have strong interactions with the ligands during MLCT, which is an obvious reference to the well-known fact that both osmium and iridium facilitate ISC.

G. Appendix G: Sufficiency of disclosure.

1. The Opposition Division disagreed that EP-238 lacks a sufficiency of disclosure. But an informed Board will find that the main request and the first auxiliary request fail to meet the requirements of Article 83 EPC, because the subject matter of at least claim 1 is not disclosed sufficiently clearly and completely to enable performance across the entire range of the claim. This gives rise to an objection of insufficiency under Article 100(b) EPC. (**Reference 2: Interlocutory Decision, ¶5.1**).

2. On one hand, regarding sufficiency of disclosure, UDC basically argued that one example from EP-238 would allow one to make any claimed embodiment without undue burden and *without needing inventive skill.* On the other hand, in rebutting the lack of inventive step, UDC argued that modifying the prior art examples would require *inventive skill* to reach an embodiment of the claimed invention. UDC's positions seem contrary. (**Reference 29: UDC's Observations, p. 10-15**).

3. Under European Patent law, the requirement of Article 83 EPC is that the skilled person should, after reading the description, be able to readily perform the invention over the whole area claimed without undue burden and without needing inventive skill. On the other hand, the objection of lack of sufficient disclosure presupposes that there are serious doubts, substantiated by verifiable facts, in this respect.

4. Sumitomo noted that original claims 1 & 16 embrace a tremendous amount of subject matter, and the *iridium compounds* and *osmium compounds* are not confined to a structure, stability, luminescence, emission lifetime, or color of emission. (**Reference 32: Sumitomo's Opposition, pp. 10-11**). However, EP-238 contains just two examples, one an *iridium compound* and the other an *osmium compound.* (**Reference 32: Sumitomo's Opposition, p. 10**). Thus, Sumitomo urged that practicing the invention as claimed would improperly require undue burden and inventive skill. (**Reference 32: Sumitomo's Opposition, p. 10**).

5. UDC responded that "only those organometallic iridium or osmium compounds which produce phosphorescence shall be chosen for an emissive layer." (**Reference 32: Sumitomo's Opposition, p. 10**). UDC alleged that the term "phosphorescence" (a noun form of the recited adjective term *phosphorescent*) refers to "emission from a triplet state, which is different from fluorescence, which refers to emission from a singlet state" (citation omitted). (**Reference 29: UDC's Observations, p. 7**). The UDC further stated that "The term 'phosphorescence' as used

in the patent is a clearly and unequivocally defined technical term…." (**Reference 29: UDC's Observations, p. 8**). However, the term is not defined so narrowly. Phosphorescence is much broader than referring to the luminescence from a triplet to singlet emission: it refers to any luminescence involving a change in spin multiplicity (a particular arrangement of paired electrons), e.g., luminescence from triplet to singlet *or vice versa*, quartet to doublet *or vice versa*, etc. would be considered phosphorescence. Thus, a *phosphorescent … compound*, as recited in UDC's claims would refer to any compound capable of such luminescence. And the statement is material, because UDC needed to convince the Opposition Division that their claims are narrower than their terms recite to preserve patentability.

6. To further narrow the breadth of the claims, UDC argued that "one of ordinary skill in the art is able to perform the invention over the whole area claimed without undue burden and without needing inventive skill." (**Reference 29: UDC's Observations, p. 11**). They addressed the color, (**Reference 29: UDC's Observations, pp. 11-12**), and the synthesis of the *compounds*. (**Reference 29: UDC's Observations, pp. 12-15**). In discussing the synthesis of *osmium compounds*, UDC point to a reference regarding synthesis of ruthenium (another transition metal having an electronic structure $Kr4d^7 5s^1$), and based on the electronic structure, they advocated that the chemistry of ruthenium would be expected to be similar to that of osmium: "Because osmium and ruthenium are in the same column of the periodic table, one of ordinary skill in the art would therefore expect analogous reactions for each." (**Reference 29: UDC's Observations, p. 11**). UDC, however, does not mention the fact that O'Brien's platinum or Ma's osmium bracket iridium on the periodic table and that iridium should behave similarly.

7. The Opposition Division sided with UDC. (**Reference 2: Interlocutory Decision, ¶5.2**).

8. Sumitomo appealed this decision to the Board. (**Reference 41: Sumitomo Grounds for Appeal, §2.3**).