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Datasheet for the decision of 21 February 2018

Case Number: T 2012/14 - 3.3.09

Application Number: 03025325.6

Publication Number: 1394870

IPC: H01L51/50, H01L51/54

Language of the proceedings: EN

Title of invention:
Phosphorescent organic light emitting device

Patent Proprietor:
THE TRUSTEES OF PRINCETON UNIVERSITY
THE UNIVERSITY OF SOUTHERN CALIFORNIA

Opponents:
OSRAM GmbH
Merck Patent GmbH
Koninklijke Philips N.V.
Siemens Aktiengesellschaft

Headword:

Relevant legal provisions:
EPC Art. 100(b), 83, 76(1), 123(2), 84, 54, 56

Keyword:
Sufficiency of disclosure over the entire scope of claim - concept fit for generalisation
Amendments - added subject-matter
Claims - clarity in opposition appeal proceedings
Novelty
Validity of priority - same invention and valid transfer of priorty right
Inventive step

Decisions cited:
G 0003/14, T 0437/14, T 0788/05

Catchword:

Europäisches Patentamt
European Patent Office
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Beschwerdekammern

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Case Number: T 2012/14 - 3.3.09

D E C I S I O N
of Technical Board of Appeal 3.3.09
of 21 February 2018

Appellant: (Patent Proprietor 1)	THE TRUSTEES OF PRINCETON UNIVERSITY P.O. Box 36 Princeton, NJ 08544-0036 (US)
Appellant: (Patent Proprietor 2)	THE UNIVERSITY OF SOUTHERN CALIFORNIA University Park Los Angeles, California 90089 (US)
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Appellant: (Opponent 1)	OSRAM GmbH Marcel-Breuer-Strasse 6 80807 München (DE)
Party as of right: (Opponent 2)	Merck Patent GmbH Postfach 64271 Darmstadt (DE)
Party as of right: (Opponent 3)	Koninklijke Philips N.V. High Tech Campus 5 5656 AE Eindhoven (NL)
Representative:	Eisenführ Speiser Patentanwälte Rechtsanwälte PartGmbB Am Kaffee-Quartier 3 28217 Bremen (DE)

Party as of right: (Opponent 5)	Siemens Aktiengesellschaft Werner-von-Siemens-Straße 1 80333 München (DE)
Representative:	Epping - Hermann - Fischer Patentanwaltsgesellschaft mbH Schloßschmidstraße 5 80639 München (DE)
Decision under appeal:	**Interlocutory decision of the Opposition Division of the European Patent Office posted on 6 August 2014 maintaining European patent No. 1394870 in amended form**

Composition of the Board:

Chairman	J. Jardón Álvarez
Members:	M. O. Müller
	F. Blumer

Summary of Facts and Submissions

I. This decision concerns the appeals filed by opponent 1 and the patent proprietors against the decision of the opposition division finding that European patent No. 1 394 870 as amended met the requirements of the EPC.

II. With their notices of opposition the opponents had requested revocation of the patent in its entirety on the grounds under Article 100(a) (lack of novelty and inventive step), 100(b) and 100(c) EPC.

III. The documents submitted during the opposition proceedings included:

E1: DE 44 28 450 A1;

E11: J. Kido et al., Chem. Lett., 1991, pages 1267 to 1270;

E15: Y. Ma et al., Synthetic Metals, volume 94, 1998, pages 245 to 248;

E18: J. J. Singh et al., "Mechanism of Phosphorescence Quenching in Photomagnetic Molecules Determined By Positron Annihilation Spectroscopy", presented at the 61st Meeting of the Southeastern Section of the American Physical Society held at Newport, VA, 10 to 12 November, 1994, 18 pages;

E33: M. A. Baldo et al., Nature, volume 395/10, 10 September 1998, pages 151 to 154;

E34: A. Shoustikov et al., Synthetic Metals,

volume 91, 1997, pages 217 to 221;

E35: P. E. Burrows et al., SPIE, volume 3148, 1997, pages 252 to 263;

E58: M. A. Baldo et al., Pure and Appl. Chem., volume 71, number 11, 1999, pages 2095 to 2106;

E63: D. F. O'Brien et al., Synthetic Metals, volume 116, 2001, pages 379 to 383;

E64: Expert declaration of Professor Thompson, signed on 6 March 2014, 3 pages;

P4: Priority document US 980986 of the opposed patent filed on 1 December 1997; and

A to C: Assignment documents relating to the transfer of priority document P4.

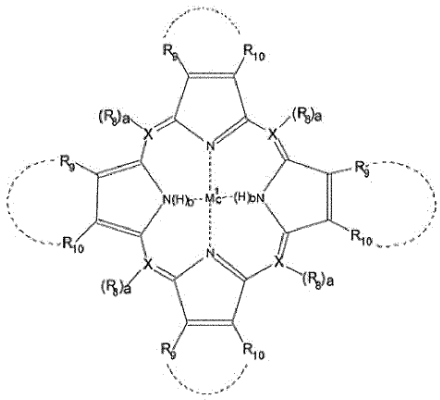
IV. The opposition division's decision was based on the claims as granted (main request) and first to third auxiliary requests.

Claim 1 (the only independent claim) of the main request read as follows:

> "1. A single or double heterostructure OLED comprising an emissive layer, wherein the emissive layer is a charge carrying layer further comprising a phosphorescent dopant compound that emits phosphorescent radiation from a triplet molecular excited state when a voltage is applied across the OLED, wherein the phosphorescent dopant compound is capable of capturing the exciton triplet energy from the charge carrying material."

Claim 1 of the first auxiliary request read as follows (amendments with regard to the main request highlighted by the board):

"1. A single or double heterostructure OLED comprising an emissive layer, wherein the emissive layer is a charge carrying layer further comprising a phosphorescent dopant compound that emits phosphorescent radiation from a triplet molecular excited state when a voltage is applied across the OLED, wherein the phosphorescent dopant compound is capable of capturing the exciton triplet energy from the charge carrying material, wherein the phosphorescent dopant compound has the following chemical structure of formula I:

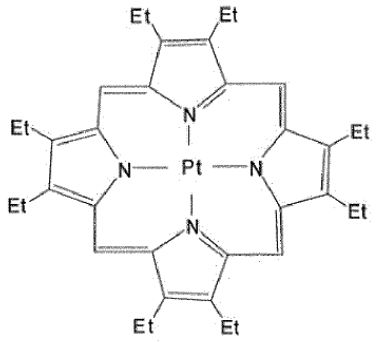


I

wherein X is C or N; R_8, R_9 and R_{10} are each independently selected from the group consisting of hydrogen, alkyl, substituted alkyl, aryl and substituted aryl; R_9 and R_{10} may be combined together to form a fused ring; M_1 is a divalent, trivalent or tetravalent metal; and a is 0 or 1; c is 1; b is 0; wherein, when X is C, then a is 1; when X is N, then a is 0."

Claim 1 of the second auxiliary request read as follows (amendments with regard to the main request highlighted by the board):

"1. A single or double heterostructure OLED comprising an emissive layer, wherein the emissive layer is a charge carrying layer further comprising a phosphorescent dopant compound that emits phosphorescent radiation from a triplet molecular excited state when a voltage is applied across the OLED, wherein the phosphorescent dopant compound is capable of capturing the exciton triplet energy from the charge carrying material, wherein the phosphorescent dopant compound is platinum octaethylporphine and has the chemical structure with the formula II



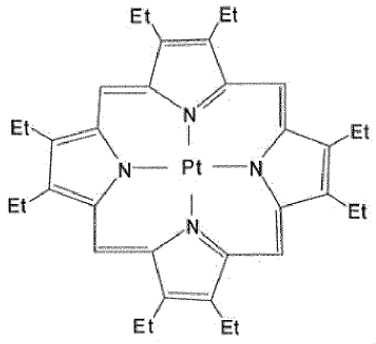
II

wherein Et is an ethyl group.

Claim 1 of the third auxiliary request read as follows (amendments with regard to the main request highlighted by the board):

"1. A single or double heterostructure OLED comprising an emissive layer, wherein the emissive layer is a charge carrying layer further comprising

a phosphorescent dopant compound that emits phosphorescent radiation from a triplet molecular excited state when a voltage is applied across the OLED, wherein the phosphorescent dopant compound is capable of capturing the exciton triplet energy from the charge carrying material, wherein the phosphorescent dopant compound is platinum octaethylporphine and has the chemical structure with the formula II



II

wherein Et is an ethyl group and wherein the charge carrying material is Alq_3.

V. The opposition division's view may be summarised as follows:

The invention as defined in the main request was insufficiently disclosed. Claim 1 effectively encompassed an infinite number of charge carrying materials and phosphorescent dopant materials, and the skilled person would have to find proper materials by trial and error. The limited number of examples provided in the patent, which merely showed one way of carrying out the invention, did not provide sufficient guidance to the skilled person in this respect.

For the same reasons, the invention as defined in the first and second auxiliary requests was insufficiently disclosed.

The third auxiliary request met the requirements of Articles 76(1) and 123(2) EPC. Claim 1 of the third auxiliary request also met the requirements of Article 84 EPC. With regard to sufficiency, no objections had been raised by the opponents, and the opposition division was satisfied that the subject-matter of claim 1 was sufficiently disclosed.

The third auxiliary request was also novel. It validly claimed the priority date of P4, so E33 did not constitute prior art.

Lastly, the subject-matter claimed in the third auxiliary request was also inventive. It differed from the closest prior art E34 or E35 in that the dopant in those documents was a fluorescent dopant, whereas the PtOEP used in the devices according to claim 1 emitted by phosphorescence. There was no indication in either E34 or E35 that the fluorescent dopant TPP could be replaced by a phosphorescent one. The photoluminescence of PtOEP was disclosed in E18, but that document did not deal with electroluminescence, so the skilled person would not consider it.

VI. With the statement of grounds of appeal, opponent 1 filed:

E65: Internet printout "Dexter-Energietransfer" from Wikipedia, dated 24 November 2014; and

E66: S. P. McGlynn et al., "Molecular Spectroscopy of the Triplet State", Prentice-Hall, 1969, pages 1 to 66.

VII. With the statement of grounds of appeal, the proprietors filed first and second auxiliary requests together with:

E67: "Organic electroluminescent materials and devices", Seizo Miyata and Hari Singh Nalwa (ed.), Amsterdam, 1997, 32 pages;

E68: L. J. Rothberg et al., "Status of and prospects for organic electroluminescence", Journal of Materials Research, volume 11, number 12, 1996, pages 3174 to 3187;

E69: K. A. King et al., "Excited-State Properties of a Triply Ortho-Metalated Iridium (III) Complex", Journal of the American Chemical Society, volume 107, 1985, pages 1431 to 1432; and

E70: Expert opinion of Professor Thompson signed on 12 December 2014 (4 pages), including annexes A (43 pages) and B (8 pages).

VIII. As the proprietors and opponent 1 are each appellant(s) and respondent(s) in the present appeal proceedings, for simplicity the board will continue to refer to the parties as the proprietors and opponents 1 to 5.

IX. With a letter dated 12 June 2015, a response was filed by opponent 1.

X. With its response dated 17 June 2015, opponent 5 filed:

E71: P. Y. Liu et al., Journal of the Korean Physical Society, volume 46, 2005, pages S66 to S69.

XI. With their response dated 19 June 2015, the proprietors filed a third auxiliary request.

XII. With its response dated 23 June 2015, opponent 2 filed:

E72: Copy of the proprietors' letter dated 13 March 2008, 5 pages.

XIII. With letters dated 26 and 29 June 2015, responses were filed by opponents 3 and 4.

XIV. With its communication dated 25 October 2017, the board communicated its preliminary opinion to the parties.

XV. A response was filed by the proprietors with their letter dated 29 December 2017.

XVI. With its letter dated 16 January 2018, opponent 4 declared that it withdrew its opposition and that it would not attend the oral proceedings.

XVII. With their letters dated 18 and 25 January and 19 February 2018, opponents 1, 3 and 5 announced that they would not attend the oral proceedings.

XVIII. On 21 February 2018, oral proceedings were held before the board in the presence of the patent proprietors and opponent 2. As announced, opponents 1 and 3 to 5 were absent.

XIX. The main request and first to third auxiliary requests are identical to the corresponding requests before the opposition division (see point IV above).

XX. The opponents' arguments which are relevant to the present decision may be summarised as follows:

Main request

The invention defined in claim 1 was insufficiently disclosed. There was no concept fit for generalisation that enabled the skilled person to select pairs of dopants and hosts meeting the functional requirement of claim 1 that the dopant must be capable of capturing the exciton triplet energy from the host. Neither claim 1 itself nor any other part of the opposed patent contained any hint that the functional requirement of claim 1 was fulfilled if the dopant met the proprietors' energy alignment requirement. In fact, E33 and E63 mentioned different requirements that needed to be fulfilled in order to allow energy to be transferred from the host to the dopant. The difficulty in finding suitable pairs of dopants and hosts was further confirmed by E58. The skilled person therefore needed trial and error to select dopant/host pairs meeting the functional requirement of claim 1. Lastly, as confirmed by E15, even if the proprietors' energy alignment requirement were met, that did not necessarily imply that the functional requirement of claim 1 was fulfilled.

The same applied to the first and second auxiliary requests.

Third auxiliary request

Claim 1 was not based on the application as filed. The passage quoted on page 60 of the application did not provide a basis since, unlike claim 1, it required the lifetime of the dopant to be no longer

than 10 µs and since it did not disclose the feature of claim 1 of phosphorescent emission from a purely molecular triplet excited state.

Furthermore, claim 1 did not meet the requirements of Article 84 EPC, since it was not clear whether the charge carrying material of the claim was the same as the charge carrying layer mentioned therein. Furthermore, the term "triplet molecular excited state" in claim 1 was unclear.

The invention as defined in claim 1 was insufficiently disclosed (for the detailed arguments of the opponents, see point 5 below).

The subject-matter of claim 1 lacked novelty over E33. This document constituted prior art under Article 54(2) EPC, since the claims of the patent did not enjoy the priority of P4. The priority document P4 did not concern the same invention as defined in claim 1, and the right to priority had not been validly transferred.

Lastly, the claimed subject-matter lacked inventive step in view of E34 or E35 in combination with E18. The skilled person would have known that far more triplet excitons than singlet excitons were generated when a voltage was applied to an OLED. He would thus look for a phosphorescent dopant and would thereby find the phosphorescent dopant PtOEP in E18. He would replace the fluorescent dopant TPP in E34 with this phosphorescent dopant and would thus arrive at the claimed subject-matter.

XXI. The proprietors' arguments which are relevant to the present decision may be summarised as follows:

Main request

The invention defined in claim 1 was sufficiently disclosed. The skilled person would be aware that, in order to fulfil the functional requirement of claim 1, the dopant had to have a lower triplet energy level than the host. This energy alignment requirement, which was disclosed in paragraph [0020] of the patent, constituted a concept fit for generalisation that allowed the skilled person to select suitable pairs of dopants and hosts meeting the functional requirement of claim 1. Contrary to the opponents' argument, E15 did not show that there were dopant/host pairs which fulfilled the energy alignment requirement but not the functional requirement of claim 1.

Third auxiliary request

Claim 1 of the third auxiliary request was based *inter alia* on page 60, lines 22 to 28, and on page 3, line 27, to page 4, line 2, of the application as filed. The passage on page 60 implicitly disclosed emission from a molecular excited state as required by claim 1. And contrary to the opponents' argument, this passage did not require a lifetime of no longer than 10 µs, and in any case such a lifetime was implicit in Alq_3 doped with PtOEP.

Contrary to opponent 1's argument, claim 1 was clear, and in fact the features addressed by opponent 1 could not be attacked for lack of

clarity since the alleged lack of clarity had not been introduced into the claims by way of amendment.

Opponent 1 had not raised any sufficiency objection against the third auxiliary request in the first-instance proceedings. The objection of lack of sufficiency was belated and amounted to an abuse of procedure. It should not be admitted into the proceedings.

In any case, the invention as defined in claim 1 was sufficiently disclosed. The skilled person no longer needed any undue burden, since the claim was now restricted to the pair PtOEP/Alq_3.

The claimed subject-matter was novel. E33 did not constitute prior art, since claim 1 validly claimed the priority of P4.

Lastly, the claimed subject-matter was also inventive over E34 in combination with E18. E34 did not provide any incentive to look for phosphorescent dopants, and E18 concerned a technical field totally different from OLEDs, namely photoluminescence. Inventive step in view of E35 was also present, since E35 did not constitute prior art.

XXII. The proprietors requested that the appealed decision be set aside and that the opposed patent be maintained as granted (main request), or on the basis of any of the first or second auxiliary requests filed with letter dated 15 December 2014 (statement of grounds of appeal), or on the basis of the third auxiliary request filed with letter dated 19 June 2015 (identical to the

request found allowable by the opposition division), implying that opponent 1's appeal be dismissed.

The proprietors also requested that the objections under Article 83 EPC against the third auxiliary request not be admitted into the proceedings.

XXIII. Opponent 2 requested that the proprietors' appeal be dismissed and that documents E67 to E70 not be admitted into the proceedings.

XXIV. The written requests of the parties not represented at the oral proceedings were as follows:

- Opponent 1 requested that the appealed decision be set aside and the patent be revoked.

- Opponents 3 and 5 requested that the proprietors' appeal be dismissed.

- Opponents 1 and 5 requested that documents E67 to E70 not be admitted into the proceedings.

Reasons for the Decision

Main request (patent as granted)

1. Sufficiency of disclosure (Article 100(b) EPC)

1.1 Claim 1 refers to: "A single or double heterostructure OLED comprising an emissive layer, wherein the emissive layer is a charge carrying layer further comprising a phosphorescent dopant compound that emits phosphorescent radiation from a triplet molecular excited state when a voltage is applied across the OLED, wherein the phosphorescent dopant compound is

capable of capturing the exciton triplet energy from the charge carrying material."

Claim 1 does not restrict the phosphorescent dopant (hereinafter "dopant") or the charge carrying material (hereinafter "host") in structural terms. The only limitation is a functional one, namely that the dopant must be capable of capturing the exciton triplet energy from the host (hereinafter "functional requirement of claim 1").

1.2 One of the key questions to be answered is whether the patent or the common general knowledge at the priority date of the patent provided any concept fit for generalisation that enabled the skilled person to select from all dopants and hosts those pairs that met the functional requirement of claim 1.

1.3 The only pairs of dopants and hosts disclosed in the opposed patent are PtOEP/Alq_3 and PTDPP/Alq_3. At the very least, the opposed patent does not contain any explicit information as to how other dopant/host pairs that meet the functional requirement of claim 1 can be identified.

1.4 The proprietors argued that the skilled person would be aware that, in order to fulfil this functional requirement, the dopant had to have a lower triplet energy level than the host. This "energy alignment requirement" constituted a concept fit for generalisation that allowed the skilled person to select other suitable dopant/host pairs meeting the functional requirement of claim 1.

1.4.1 However, neither claim 1 itself nor any other part of the opposed patent contains any hint that the

functional requirement of claim 1 is fulfilled if the dopant and host meet the proprietors' energy alignment requirement.

During the oral proceedings, the proprietors argued that the relevance of the energy alignment requirement was disclosed in paragraph [0020] of the opposed patent. In particular they referred to the following sentence in that paragraph: "Materials that are present as host and dopant are selected so as to have a high level of energy transfer from the host to the dopant material". However, this sentence merely reiterates the functional requirement of claim 1, namely that the dopant is capable of capturing, i.e. receiving by way of energy transfer, the exciton triplet energy from the host. Nothing in this sentence refers to the proprietors' energy alignment requirement.

1.4.2 There is also no evidence on file that part of the common general knowledge at the priority date of the opposed patent was that the functional requirement of claim 1 was fulfilled if the proprietors' energy alignment requirement was met. In fact, even after the priority date, documents relating to the transfer of exciton triplet energy from hosts to dopants did not make any reference to the proprietors' energy alignment requirement:

E33 is an article in Nature with one of the inventors of the patent as co-author. It was published after the fourth priority date of the opposed patent (1 December 1997; see also the discussion of novelty below). It discloses that energy is transferred from the triplet state of the host Alq_3 to the dopant PtOEP (first and second paragraph in the left-hand column and third full paragraph in the right-hand column of page 151). Even

though E33 discusses at length the requirements for this energy transfer to happen, it makes no reference at all to the proprietors' energy alignment requirement. On the contrary, it mentions only that strong absorption of the PtOEP at wavelengths corresponding to the peak emission of the charge carrying material Alq_3 makes it a suitable dopant for OLEDs (third full paragraph in the right-hand column of page 151). As not disputed by the proprietors, this does not correspond to their energy alignment requirement.

Also E63, which was published in 2001, i.e. more than two years after the most recent priority date of the opposed patent, refers to the transfer of triplet energy from a host to a dopant in OLEDs (first full sentence in the right-hand column of page 379). And this document is also entirely silent about the proprietors' energy alignment requirement. It again mentions a different requirement being needed for the energy transfer to happen, namely that the phosphorescent spectrum of the host overlaps with the singlet-triplet absorption spectrum of the guest (first full sentence in the right-hand column of page 379).

Hence, even after the priority date of the opposed patent it seems not to have been known, let alone commonly known, that a dopant/host pair fulfils the functional requirement of claim 1 if it meets the proprietors' energy alignment requirement.

1.5 In fact it is not even true that the functional requirement of claim 1 is fulfilled if the proprietors' energy alignment requirement is met:

1.5.1 E15 discloses an OLED with an emissive layer containing an osmium complex (as dopant) and PVK (as host) (first paragraph of point 2.3 on page 246). As acknowledged by the proprietors during the oral proceedings, the pair of osmium complex and PVK fulfils the proprietors' energy alignment requirement. Nevertheless, as can be deduced from the first full paragraph of the left-hand column of page 248 of E15, emission from this OLED results from the recombination of electrons and holes directly in the osmium complex (trapped electrons move to the LUMO and holes to the HOMO of the osmium complex), rather than from the capturing of any exciton triplet energy from the PVK as required by the functional requirement of claim 1. Consequently, even though the dopant/host pair in E15 meets the proprietors' energy alignment requirement, the functional requirement of claim 1 is not fulfilled.

1.5.2 The proprietors argued that the functional requirement in claim 1 was not that the triplet energy was transferred from the host to the dopant but merely that the dopant was "capable" of capturing this triplet energy from the host. No actual transfer was needed. Therefore, the fact that no such transfer occurred in E15 did not imply that the functional requirement of claim 1 was not fulfilled.

The board does not find this argument convincing. The functional requirement in claim 1 that the dopant contained in the claimed OLED must be capable of capturing the exciton triplet energy from the host can only mean that when the OLED is operated, i.e. when a voltage is applied, the energy from the host is captured by and thus transferred to the dopant.

1.6 Hence, at the priority date of the patent, the skilled person did not have at his disposal any concept fit for generalisation that allowed him to select pairs of dopants and hosts meeting the functional requirement of claim 1. He thus had to identify suitable pairs by trial and error.

1.7 The difficulty in finding suitable dopant/host pairs is confirmed by E58. This document, one of the authors of which is an inventor of the patent, discloses the following:

> "Unlike the case of PtOEP in ALq_3, the triplet transfer efficiency of PtOEP in CBP is unknown. Indeed, the larger offset in HOMO and LUMO levels between PtOEP and CBP may encourage charge trapping and direct exciton formation on PtOEP molecules. Further work is required to clarify this issue." (first paragraph below figure 6 on page 2102)

Hence, even though the authors in E58 used the only dopant exemplified in the opposed patent (PtOEP), they are nevertheless not sure whether it is capable of capturing exciton triplet energy from the host CBP.

1.8 Therefore, the ground under Article 100(b) EPC prejudices the maintenance of the patent in the form of the main request.

1.9 E67 to E70 were filed by the proprietors with their statement of grounds of appeal. Opponents 1, 2 and 5 requested that these documents not be admitted into the proceedings. During the oral proceedings, the board admitted these documents into the proceedings, since they were a legitimate reaction to the opposition

division's decision. Since these documents are not relevant to the present decision, no detailed reasons need to be given.

First and second auxiliary requests

2. Sufficiency of disclosure (Article 83 EPC)

2.1 In the first and second auxiliary requests, the dopant is more narrowly defined in terms of its chemical structure. However, in the same way as in claim 1 of the main request, no structural limitation is present for the host. Hence, the only definition present for the host is still that it must meet the functional requirement of claim 1, namely that its exciton triplet energy must be such that it can be captured by the dopant. Therefore, for the reasons given above with regard to the main request, the skilled person needs trial and error to find suitable host materials. Consequently, the invention as defined in claim 1 of the first and second auxiliary requests is not sufficiently disclosed either.

Third auxiliary request

3. Amendments - Articles 76(1) and 123(2) EPC

3.1 The dopant and host have been specified in claim 1 as PtOEP and Alq_3.

3.2 Page 60, lines 22 to 28, of the application as filed reads as follows:

> "In addition to selecting phosphorescent compounds according to their phosphorescent lifetimes, which for certain applications may mean selecting

compounds having a phosphorescent lifetime not longer than about 10 µs, the phosphorescent compounds may be selected according to their ability to effectively capture the exciton triplet energy from a charge carrier material and then to emit that excitation energy as phosphorescence in a narrow emission band corresponding to a highly saturated color, such as demonstrated by PtOEP in an Alq_3-based OLED."

This passage discloses all features of claim 1, except for the feature that the OLED is a single or heterostructure OLED. More specifically, it discloses a PtOEP in an Alq_3-based OLED together with the functional requirement of claim 1 that the dopant must be capable of capturing the exciton triplet energy from the host (charge carrier material).

3.3 The remaining feature of claim 1 that the OLED is a single or heterostructure OLED is disclosed in general terms on page 3, line 27, to page 4, line 2, of the application as filed. This disclosure, due to its general nature, applies to all embodiments described in the application as filed, including that disclosed on page 60, lines 22 to 28. Therefore, contrary to opponent 1's argument, the combination of the disclosure of a single or heterostructure OLED with the disclosure of the passage on page 60 does not extend beyond the application as filed.

3.4 Opponent 1 argued in writing that the passage on page 60 of the application as filed required the lifetime of the dopant to be no longer than 10 µs. Since this requirement was missing in claim 1, this passage could not provide a basis for this claim.

The board does not agree. This passage requires a lifetime of no longer than 10 µs only "for certain applications"; hence according to this passage such a lifetime is not necessarily mandatory. Regardless of this, without any proof to the contrary, it must be assumed that in the PtOEP/Alq_3 pair to which claim 1 is now restricted, the lifetime is inherently no longer than 10 µs.

3.5 Opponent 1 also argued in writing that the passage on page 60 of the application as filed did not disclose the feature of claim 1 that the phosphorescent radiation was emitted from a triplet molecular excited state.

However, during the oral proceedings, Professor Thompson confirmed in the context of sufficiency of disclosure that PtOEP would emit not from an atomic but from a molecular excited state. Hence, the disclosure of PtOEP on page 60 of the application as filed implies emission from a molecular excited state. The feature of claim 1 that the PtOEP emits phosphorescent radiation from a triplet molecular excited state is thus implicitly disclosed in the passage on page 60 of the application as filed. In that respect it is not true that, as argued by opponent 1, Professor Thompson had acknowledged in his declaration D64 that the emission of PtOEP did not come from a molecular excited state. What Professor Thompson was focusing on in D64 was the emission of lanthanides, and in particular those disclosed in E1 and E11, namely europium and terbium. PtOEP is not a lanthanide and in fact is not mentioned in E64 at all.

3.6 Lastly, opponent 1 argued in writing that there was an overlap between the molecular orbitals of the dopant

and host in PtOEP/Alq_3, such that the excited state of the dopant disclosed on page 60 of the application as filed was not a purely molecular state. However, claim 1 does not require radiation from a purely molecular excited state. Therefore the fact that such a state is not disclosed on or implied by page 60 of the application as filed does not disqualify this passage as a basis for claim 1.

3.7 Thus claim 1 of the third auxiliary request is based on the application as filed.

3.8 No objection was raised against the remaining claims 2 and 3 of the third auxiliary request, and the board is convinced that they too are based on the application as filed.

3.9 The claims of the third auxiliary request thus meet the requirements of Article 123(2) EPC. The passages of the application as filed discussed above as a basis for claim 1 are present in an identical form in the parent application as filed. Therefore the claims of the third auxiliary request also meet the requirements of Article 76(1) EPC.

4. Amendments - Article 84 EPC

4.1 Opponent 1 argued that it was not clear whether the charge carrying material of line 14 of claim 1 was the same as the charge carrying layer mentioned in line 10 of that claim, whether it was part thereof, or whether it was something different.

However, the part of claim 1 objected to is identical to claim 1 as granted. Consequently, if there were to be lack of clarity, it was already present in claim 1

as granted and was thus not introduced by way of amendment. Therefore the alleged lack of clarity cannot be objected to in the present opposition appeal proceedings (G 3/14). Regardless of this, it is clear that the charge carrying layer contains the charge carrying material and phosphorescent dopant. It is thus also clear that the charge carrying material in claim 1 is part of the charge carrying layer. There is thus no lack of clarity.

4.2 Opponent 1 argued that it was not clear what the term "triplet molecular excited state" in claim 1 meant. However, this term too is part of the text that was present in claim 1 as granted. Opponent 1 argued that this lack of clarity was introduced by way of amendment, namely by the restriction of the dopant and host. The restriction of the dopant however comes from granted claim 3 and thus cannot introduce any lack of clarity not present in the granted claims. Furthermore, the board does not see how the restriction of the host to Alq_3, even though coming from the description, introduces any lack of clarity not present in the granted claims. Hence, a clarity objection is not possible in opposition appeal proceedings.

5. Sufficiency (Article 83 EPC)

5.1 The objection that led to the rejection of the main request for lack of sufficiency of disclosure, namely that the skilled person has to find suitable pairs of dopants and hosts by trial and error, no longer applies. Unlike in claim 1 of the previous requests, the dopant and host in claim 1 of the third auxiliary request are restricted to one single pair, namely PtOEP/Alq_3. It follows from figure D4 of the opposed patent that with an increasing level of PtOEP, the

emission from the exciton triplet state of Alq_3 at around 520 nm increasingly disappears, which implies that the energy of the exciton triplet is transferred from Alq_3 to the PtOEP. Hence, in the specific pair PtOEP/Alq_3 as defined in claim 1, the dopant PtOEP is capable of capturing the exciton triplet energy from the host Alq_3. This pair thus meets the functional requirement of claim 1.

5.2 Opponent 1's remaining arguments all presented in writing are not convincing:

5.2.1 Opponent 1 argued that since it was not clear whether the charge carrying material in claim 1 was the same as the charge carrying layer, the skilled person would not be able to carry out the invention over the entire scope of claim 1.

This argument is not convincing. As set out above in discussing Article 84 EPC, the lack of clarity referred to by opponent 1 does not exist. In the absence of any lack of clarity, there can be no insufficiency arising from lack of clarity.

5.2.2 Opponent 1 further argued that due to the overlap of the molecular orbitals of the dopant and host, no purely molecular triplet excited state was present in PtOEP/Alq_3, and hence an emission from such a state was not possible.

This argument is not convincing either. As set out above in discussing Article 123(2) EPC, claim 1 does not require emission from a purely molecular triplet state. Hence the fact that such emission is not possible does not matter.

5.2.3 Opponent 1 also argued that the PtOEP/Alq_3 pair did not result in a short lifetime of 10 µs and that no teaching was available as to how this short lifetime could be obtained.

This argument too must fail. As set out above in discussing Article 123(2) EPC, in the absence of any proof to the contrary, it must be assumed that PtOEP/Alq_3 inherently has this lifetime. And even if it did not, the board fails to see how this would lead to insufficiency of disclosure.

5.2.4 Opponent 1 also argued that there was no proof that the claimed invention worked with a double heterostructure OLED. Furthermore, there was no proof that a single heterostructure OLED could be made that was different from the concrete example having the layer sequence ITO/TPD/Alq_3(PtOEP)/Mg-Ag.

However, in the absence of any proof from opponent 1 that the invention does not work with a heterostructure OLED or with a single structure OLED other than ITO/TPD/Alq_3(PtOEP)/Mg-Ag, this argument must fail.

5.2.5 Lastly, opponent 1 argued that the patent did not contain any teaching as to how it could be determined whether an emission occurred from a triplet molecular excited state or not. The skilled person therefore did not know whether he was working within or outside of the scope of claim 1.

As set out by Professor Thompson during the oral proceedings, the skilled person can distinguish between an emission from a molecular and atomic excited state on the basis of the wavelength of the emission. Furthermore, the question whether the skilled person

knows whether he is working within or outside of the scope of the claim is a matter for Article 84 rather than 83 EPC.

5.3 Therefore, the invention as defined in claim 1 of the third auxiliary request is sufficiently disclosed.

5.4 The proprietors requested that the opponents' objections under Article 83 EPC not be admitted into the proceedings. Given that these objections were found not to be convincing, there was no need to decide on this request.

6. Novelty

6.1.1 According to opponent 1, the subject-matter of claim 1 lacked novelty over E33.

6.1.2 Scientific article E33 was published on 10 September 1998, which is before the filing date of the opposed patent (8 October 1998). E33 thus constitutes prior art under Article 54(2) EPC only if the priority of the opposed patent is not valid. This was a matter of dispute between the parties.

The proprietors argued that the priority date of the claims was the filing date of priority document P4, i.e. 1 December 1997.

6.1.3 Opponent 1 argued that the subject-matter of claim 1 did not enjoy the priority of P4, since P4 did not concern the same invention as defined in that claim.

This is not correct. P4 contains a disclosure virtually identical to that on page 3, line 27, to page 4, line 2, and page 60, lines 20 to 28, of the application

as filed, namely on page 3, lines 23 to 32, and on page 14, line 29, to page 15, line 3. As set out above in discussing Article 123(2) EPC, the two passages provide a basis for claim 1 and hence disclose the same invention as defined in that claim.

6.1.4 Opponent 1 furthermore contested the validity of the priority on the ground that the right to priority had not been validly transferred.

The applicants for the priority application P4 initially were Messrs Forrest, Burrows, Thompson, You, Shoustikjov and Sibley. As evidenced by document A and its correction (document B), Messrs Forrest and Burrows assigned their right to priority to The Trustees of Princeton University. As further evidenced by document C, Messrs Thompson, You, Shoustikjov and Sibley assigned their right to priority to The University of Southern California.

Opponent 1 did not dispute the content of documents A to C. It also did not dispute that the priority rights had been transferred before the later application leading to the opposed patent had been filed. It did however argue that the priority right had not been validly transferred since there was not one applicant in the later application to whom the priority right of all applicants of the priority application had been transferred. Opponent 1 cited T 788/05 in this respect. However, this decision concerns a different case, namely where the priority application was in the name of two applicants (Terumo and Tokin), while the later application was only in the name of one of these applicants (Terumo). Furthermore, no proof whatsoever was provided by opponent 1 that there was any

jurisdiction under which the transfer of priority as it had happened in the present case would not be valid.

6.1.5 Thus claim 1 enjoys the priority of P4. E33 therefore does not constitute prior art under Article 54(2) EPC, and so the only novelty objection raised against the third auxiliary request must fail. Thus the subject-matter of claim 1, and by the same token of the remaining claims 2 and 3, is novel.

7. Inventive step

7.1 Opponent 1 attacked inventive step on the basis of E34 in combination with E18.

7.2 E34 discloses an OLED with an Alq_3 matrix doped with the fluorescent emitting material TPP (second line of the right-hand column on page 217 as well as the first sentence of section 3.1 on page 218). According to the last line of the left-hand column and the first line of the right-hand column of page 217, excitons from Alq_3 are transferred to the dopant.

7.3 The claimed subject-matter differs from this disclosure in that the emitting material is the phosphorescent dopant PtOEP rather than the fluorescent TPP.

7.4 Opponent 1 argued that the problem solved in view of E34 was the provision of an OLED with high efficiency.

7.5 Opponent 1 further argued that the skilled person would know that far more triplet excitons than singlet excitons were generated when a voltage was applied to an OLED. The skilled person would thus choose a phosphorescent dopant. Looking for such a dopant, he would also consider neighbouring technical fields such

as photoluminescence and would thereby find E18. This document on page 4 disclosed PtOEP as a dopant with high efficiency. The skilled person would replace the fluorescent dopant TPP in E34 with this phosphorescent dopant PtOEP and would thus arrive at the claimed subject-matter.

7.6 The board does not find this argument convincing.

The skilled person starting from the fluorescent OLEDs of E34 and faced with the problem of finding highly efficient OLEDs would have no reason to look for OLEDs in which emission was created by the completely different mechanism of phosphorescence. Even less would he look for a solution to this problem in the completely different technical field of photoluminescence, with which E18 is concerned. Reference is made in this respect to point 10.1.7 of T 437/14, where the board held that the property of being phosphorescent upon irradiation with light (i.e. of showing photoluminescence) is irrelevant to the property aimed at in OLEDs, namely that of being phosphorescent when an electrical voltage is applied.

7.7 Therefore the skilled person would not have applied the PtOEP of E18 in the OLED of E34 and would not have arrived at the subject-matter of claim 1. Hence the subject-matter of this claim, and by the same token of the remaining claims 2 and 3, is inventive in view of E18 and E34.

7.8 Opponent 1 also attacked inventive step on the basis of E35 in combination with E18. E35 was published in 1997 ("/97" in the footnote on the first page). The proprietors contested that E35 was published before the priority date of P4, i.e. 1 December 1997. In the

absence of any proof to the contrary, E35 does not constitute prior art and thus is not citable against inventive step.

Furthermore, in the same way as E34, E35 discloses TPP in Alq_3. Therefore even if E35 were prior art, for the reasons given above with regard to E34 it would not be prejudicial to inventive step.

7.9 Thus the third auxiliary request, which is the request found allowable by the opposition division, meets the requirements of the EPC.

Order

For these reasons it is decided that:

The appeals are dismissed.

The Registrar: The Chairman:

M. Cañueto Carbajo J. Jardón Álvarez

Decision electronically authenticated