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**Datasheet for the decision  
of 14 June 2021**

**Case Number:** T 0079/16 - 3.3.02

**Application Number:** 04705503.3

**Publication Number:** 1602648

**IPC:** C07D235/18, C07D235/20,  
C09K11/06, H01L51/00,  
C07D401/10

**Language of the proceedings:** EN

**Title of invention:**  
Nitrogen-containing heterocycle derivative and organic  
electroluminescent element using the same

**Patent Proprietor:**  
IDEMITSU KOSAN CO., LTD.

**Opponent:**  
Merck Patent GmbH

**Headword:**

**Relevant legal provisions:**  
EPC Art. 54, 56, 83

**Keyword:**

Novelty

Inventive step

Sufficiency of disclosure

**Decisions cited:**

T 0177/08

**Catchword:**



**Beschwerdekammern**

**Boards of Appeal**

**Chambres de recours**

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Case Number: T 0079/16 - 3.3.02

**D E C I S I O N**  
**of Technical Board of Appeal 3.3.02**  
**of 14 June 2021**

**Appellant:** Merck Patent GmbH  
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**Representative:** Merck Patent GmbH  
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**Decision under appeal:** **Interlocutory decision of the Opposition  
Division of the European Patent Office posted on  
12 November 2015 concerning maintenance of the  
European Patent No. 1602648 in amended form.**

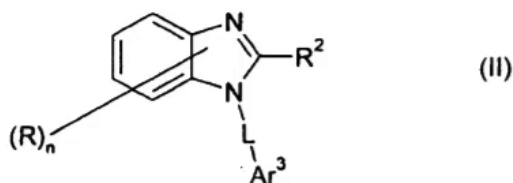
**Composition of the Board:**

**Chairman** M. Maremonti  
**Members:** S. Bertrand  
R. Romandini

## Summary of Facts and Submissions

- I. The appeal lodged by the opponent (appellant) lies from the interlocutory decision of the opposition division that European patent No. 1 602 648 in its form modified on the basis of the main request and the invention to which it related met the requirements of the EPC.
- II. The main request contained 13 claims, independent claim 1 of which read as follows:

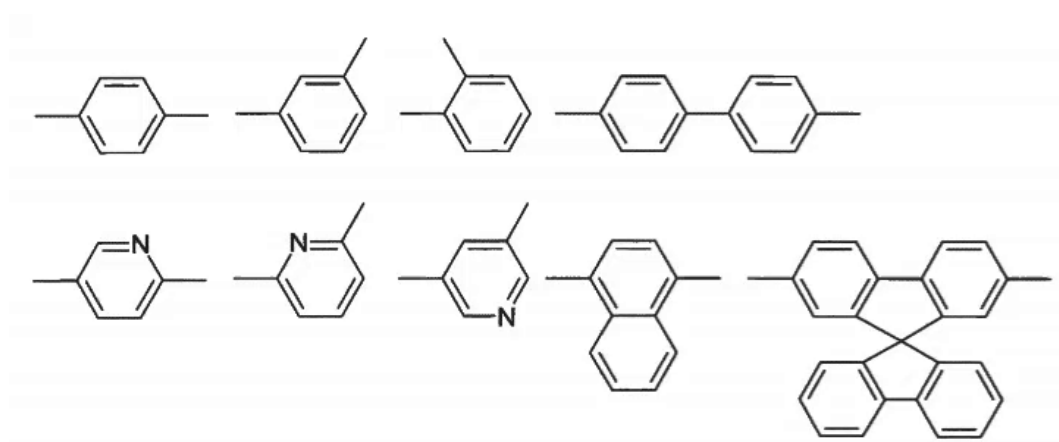
*"1. A derivative of a heterocyclic compound having a nitrogen atom represented by the following general formula (II)*



*wherein R represents a hydrogen atom, an aryl group having 6 to 60 carbon atoms, a pyridyl group, a quinolyl group; an alkyl group having 1 to 20 carbon atoms or an alkoxy group having 1 to 20 carbon atoms, and R does not have a substituent, or R has a substituent selected from the group consisting of an alkyl group having 1 to 20 carbon atoms, an alkoxy group having 1 to 20 carbon atoms, an aryloxy group having 6 to 40 carbon atoms, a diarylamino group having 12 to 80 carbon atoms, an aryl group having 6 to 40 carbon atoms and a heteroaryl group having 3 to 40 carbon atoms; n represents an integer of 0 to 4;*

$R^2$  represents a hydrogen atom, an aryl group having 6 to 60 carbon atoms, a pyridyl group, a quinolyl group; an alkyl group having 1 to 20 carbon atoms or an alkoxy group having 1 to 20 carbon atoms, and  $R^2$  does not have a substituent, or  $R^2$  has a substituent selected from the group consisting of an alkyl group having 1 to 20 carbon atoms, an alkoxy group having 1 to 20 carbon atoms, an aryloxy group having 6 to 40 carbon atoms and an aryl group having 6 to 40 carbon atoms;

$L$  is selected from the following groups:



and  $L$  does not have a substituent;

$Ar^3$  represents an aryl group having 6 to 60 carbon atoms, a pyridyl group, a quinolyl group, an alkyl group having 1 to 20 carbon atoms, or an alkoxy group having 1 to 20 carbon atoms, and  $Ar^3$  does not have a substituent, or  $Ar^3$  has a substituent selected from the group consisting of an alkyl group having 1 to 20 carbon atoms, an alkoxy group having 1 to 20 carbon atoms, an aryloxy group having 6 to 40 carbon atoms, a diarylamino group having 12 to 80 carbon atoms, an aryl group having 6 to 40 carbon atoms and a heteroaryl group having 3 to 40 carbon atoms;

or  $Ar^3$  represents a group represented by  $-Ar^1-Ar^2$ , in which  $Ar^1$  represents an arylene group having 6 to 60 carbon atoms, a pyridylene group, or a quinolinylene group, and  $Ar^1$  does not have a substituent, or  $Ar^1$  has a substituent selected from the group consisting of an alkyl group having 1 to 20 carbon atoms, an alkoxy group having 1 to 20 carbon atoms, an aryloxy group having 6 to 40 carbon atoms, a diarylamino group having 12 to 80 carbon atoms, an aryl group having 6 to 40 carbon atoms and a heteroaryl group having 3 to 40 carbon atoms;

$Ar^2$  represents an aryl group having 6 to 60 carbon atoms, a pyridyl group, a quinolyl group, an alkyl group having 1 to 20 carbon atoms, or an alkoxy group having 1 to 20 carbon atoms, and  $Ar^2$  does not have a substituent, or  $Ar^2$  has a substituent selected from the group consisting of an alkyl group having 1 to 20 carbon atoms, an alkoxy group having 1 to 20 carbon atoms, an aryloxy group having 6 to 40 carbon atoms, a diarylamino group having 12 to 80 carbon atoms, an aryl group having 6 to 40 carbon atoms and a heteroaryl group having 3 to 40 carbon atoms."

III. The following documents are referred to in the present decision:

- |    |   |
|----|---|
| D2 | JP 2003 229279 A  |
| D4 | JP 2002 047274 A  |
| D5 | US 2002/0055014 A   |
| D6 | JP 2002 038141 A  |
| D7 | Extract from Wikipedia on Anthracene<br>"Delocalized chemical bonding"  |
| D8 | Jerry March: "Advanced organic chemistry",<br>1992, John Wiley & Sons, New York, US, vol.<br>4th ed., pages 40-44 |
| D9 | US 5 935 721 A  |

- D10 JP 3 588978 B2
- D11 Table 1-1 submitted by the appellant with the statement of grounds of appeal
- D12 Hardcopy of <http://goldbook.iupac.org/H02792.html>, definition of "heteroarenes"
- D13 Hardcopy of <http://goldbook.iupac.org/H02791.html>, definition of "heteroaryl groups"
- D14 Additional experimental data filed on 27 October 2016 by the respondent

IV. The opposition division came *inter alia* to the following conclusions:

- The claims according to the main request fulfilled the requirements of Article 123(2) EPC.
- The invention as defined in the claims of the main request was sufficiently disclosed within the meaning of Article 83 EPC.
- The subject-matter of the claims according to the main request was novel in view of the disclosures of D1 to D5.
- The subject-matter of the claims according to the main request involved an inventive step over D5 or D6 as the closest prior art.

V. In its statement setting out the grounds of appeal, the appellant contested the reasoning of the opposition division. It submitted that the invention defined in the claims according to the main request filed during the opposition proceedings was not sufficiently disclosed and that the subject-matter of the claims of the aforementioned main request lacked novelty (in view of D2 and D4) and did not involve an inventive step

(considering either D5 or D6 as the closest prior art). Furthermore, it submitted D11. D11 contained experimental data that corresponded to the data submitted during oral proceedings before the opposition division (see top of page 4 of the minutes). D11 summarised the technical data provided in the originally filed application.

- VI. In its reply to the statement of grounds of appeal, the patent proprietor (respondent) provided counter-arguments regarding sufficiency of disclosure, novelty and inventive step. Documents D12 and D13 were submitted to provide a definition of the terms "heteroarenes" and "heteroaryl groups".
- VII. With its letter of 27 October 2016, the respondent filed D14, the document comprising experimental data for supporting inventive step in view of D6 as the closest prior art.
- VIII. On 12 December 2019, the board issued a communication in preparation for the oral proceedings to be scheduled as requested by the parties.
- IX. With a letter dated 18 March 2020, the respondent submitted new auxiliary requests 1 to 10 and further arguments regarding novelty.
- X. In the letter of 12 May 2020, the respondent further commented on the novelty and inventive step of the subject-matter of claim 1 of the main request.
- XI. With its letter of 8 June 2021, the appellant withdrew its request for oral proceedings and stated that it would not be attending oral proceedings.
- XII. Oral proceedings before the board were held by videoconference on 14 June 2021 in the absence of the



appellant, in accordance with Rule 115(2) EPC and Article 15(3) RPBA.

XIII. The appellant's case, where relevant to the present decision, can be summarised as follows:

Novelty

- Compound (3) of D2 and compound (2) of D4 were novelty-destroying for the subject-matter of claim 1 of the main request. The phenylbenzimidazolyl group of these compounds corresponded to the substituent of Ar<sup>3</sup> according to formula (II) depicted in claim 1 of the main request.

Inventive step

- Either D5 or D6 could be considered as the closest prior art. Both documents were concerned with the provision of heterocyclic compounds useful in electroluminescent (EL) devices.
- The distinguishing feature of claim 1 in view of D6 was the radical -L-Ar<sup>3</sup>.
- It was known to the skilled person that the structural modification of one compound led to unpredictable behaviours regarding the performance of electroluminescence (EL) devices including that compound. The generalisation of the effect observed with compound (9-7) (compound of synthesis example 1 of the patent, according to claim 1) to all compounds encompassed by claim 1 was not credible.
- No technical effect was achieved by the claimed compounds in comparison with the compounds of D6, in particular compound 14 of D6. Considering D6 as the closest prior art, the objective technical

problem was to provide an alternative compound. The alternative was obvious in view of D6. It was obvious to further substitute the phenyl group in position 1 of the benzimidazole moiety.

- Even if the technical effect exhibited by compound (9-7) were considered and the technical problem were formulated accordingly, the claimed solution to the problem would have been obvious in view of D6 in combination with D9 or D10, taking into consideration the common general knowledge represented by D7 and D8.
  
- Considering compound 224 of D5 (page 63) as the closest prior art, the distinguishing feature of claim 1 was the exchange of the substituents between positions 1 and 2 of the benzimidazole moiety. For the same reasons as for D6, there was no effect originating from the distinguishing feature. The technical problem was to provide an alternative compound. The exchange of the substituents between positions 1 and 2 of the benzimidazole moiety was a matter of routine experimentation for the skilled person.

#### Sufficiency of disclosure

- The skilled person was faced with undue burden when trying to manufacture the claimed compounds in view of the huge number of compounds encompassed by claim 1. The compounds according to claim 1 comprised various positions that might be substituted and multiple possible substituents. The description of the application as filed did not disclose how to prepare all these compounds.

- It had to be concluded that the claimed subject-matter was not sufficiently disclosed in the patent.

XIV. The respondent's case, where relevant to the present decision, can be summarised as follows:

Main request - novelty

- Neither claim 1 of the main request nor the specification of the patent in suit allowed for heteroaryl substituents being substituted with phenyl. Claim 1 defined the radicals that could have a substituent (i.e. R, R<sup>2</sup>, Ar<sup>3</sup>, Ar<sup>1</sup>, Ar<sup>2</sup>) and the radical having no substituent (i.e. L). According to the definitions provided in D12 and D13, a heteroaryl group was a group derived from a heteroarene by removal of a hydrogen atom from any ring atom, and "heteroarenes" in turn referred to unsubstituted compounds. This interpretation was in line with T 177/08. Thus, compound (3) of D2 and compound (2) of D4 did not correspond to a compound of formula (II) as defined in claim 1 of the main request.

Auxiliary request 1

- Novelty
  - The phenylbenzimidazolyl group of compound (3) of D2 and compound (2) of D4 did not correspond to a radical Ar<sup>3</sup> as defined in claim 1 of auxiliary request 1.
- Inventive step
  - Claim 1 presented a novel selection of the compounds of D6.

- The data presented in D14 showed a higher value of the current efficiency at a driving voltage of 3V when compound ET-1, corresponding to compound (9-7) according to claim 1 of auxiliary request 1, was used in an EL device instead of compound ET-2, corresponding to compound 14 of D6.
- The objective technical problem was the provision of compounds that were suitable as an electron injection or transport layer in an organic EL element leading to improved luminance at lower voltages.
- D6, D7, D8, D9, D10 did not provide any motivation to modify any compound of D6 to arrive at the invention of the patent in suit as defined in claim 1 of auxiliary request 1.
- Considering D5 as the closest prior art, in particular compound 224 disclosed on page 63, the opponent had not shown what would have motivated the skilled person to modify this particular compound in such a manner as to arrive at the subject-matter of claim 1. D5 did not render obvious the claimed invention. The appellant's approach was based on an ex post facto analysis.
- The claimed subject-matter involved an inventive step.
- Sufficiency of disclosure
  - A person skilled in the art who read the description understood that, following the reaction scheme of synthesis example 1 of the patent, further compounds falling within the scope of formula (II) were obtained by

appropriately selecting the corresponding starting compounds. A person skilled in the art could extend the teaching of the patent to the whole scope claimed without undue burden.

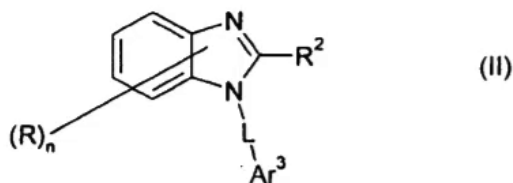
XV. The appellant requested that the decision under appeal be set aside and that the patent be revoked in its entirety.

XVI. The respondent requested that the appeal be dismissed, meaning that the patent would be maintained on the basis of the main request found allowable by the opposition division. Alternatively, it requested that the patent be maintained on the basis of the claims of one of auxiliary requests 1 to 10 as filed with the letter dated 18 March 2020.

### Reasons for the Decision

Main request (comprising the set of claims 1-13 filed with the letter of 11 September 2014, subject to the corrections made in the letter dated 29 September 2015)

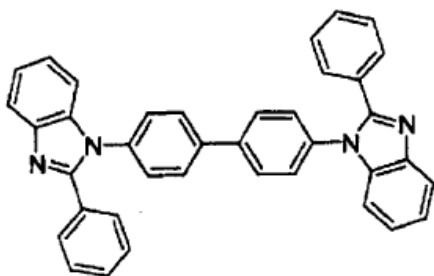
1. Claim 1 of the main request (II, *supra*) relates to a compound of formula (II) essentially characterised by radicals L and Ar<sup>3</sup>:



2. Novelty under Article 54 EPC

The appellant raised a novelty objection against claim 1 in view of compound (3) of D2 and compound (2) of D4.

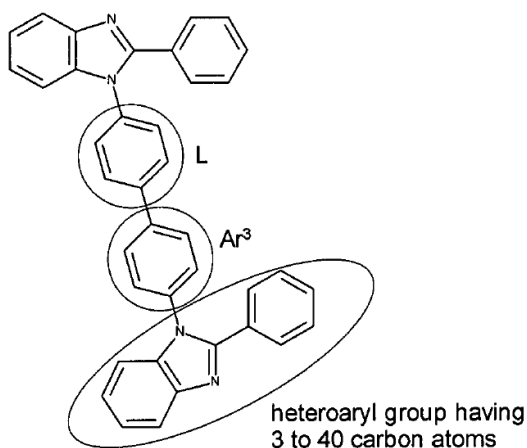
2.1 D2 discloses in paragraph [0034] compound (3), represented by the following formula:



D4 (paragraph [0022]) discloses compound (2) of formula 9, which is the same compound as compound (3) of D2.

Claim 1 of the main request relates to a benzimidazole derivative of formula (II) (1, *supra*).

The compound (3) of D2 can be represented, using the radicals of formula (II) according to claim 1 of the main request, as follows:



Using the radicals of the general formula (II) of claim 1 of the main request, the para-phenylene of compound (3) of D2 corresponds to one of the groups defining L (see the first group defining L in claim 1 of the main request). The second para-phenylene group of compound (3) of D2 corresponds to  $Ar^3$ , which may be an aryl group having 6 to 60 carbon atoms. The phenylbenzimidazolyl group of compound (3) of D2 is considered a **substituent of  $Ar^3$** , which may be a **heteroaryl group having 3 to 40 carbon atoms**.

A benzimidazolyl group is a heteroaryl group. The phenylbenzimidazolyl group, identified above, is considered a (phenyl-) substituted heteroaryl group. This substituted heteroaryl group has 13 carbon atoms and thus corresponds to the definition of the substituent of  $Ar^3$  ("a heteroaryl group having 3 to 40 carbon atoms") as included in claim 1 at issue.

It was a matter of dispute between the parties whether the substituent of  $Ar^3$ , as defined in claim 1 of the main request, could be substituted itself.

- 2.2 The respondent submitted that neither claim 1 of the main request nor the specification of the patent in suit allowed for heteroaryl being substituted with phenyl. Claim 1 defined radicals that could have a substituent (i.e. R,  $R^2$ ,  $Ar^3$ ,  $Ar^1$ ,  $Ar^2$ ) and a radical having no substituent (i.e. L). In the absence of any indication, the heteroaryl group listed in the definition of the substituent of  $Ar^3$  was to be considered unsubstituted. The respondent further pointed to original claims 4, 5, 7 and 8, which use the formulation: "*heteroaryl group having 3 to 40 carbon atoms and may have a substituent*". The reference to

substituents would have been unnecessary if this was already implied by the term *heteroaryl group*.

Furthermore, according to the definition provided in D12 and D13, a heteroaryl group was a group derived from a heteroarene by removal of a hydrogen atom from any ring atom, and "heteroarenes" in turn referred to unsubstituted compounds. The term "heteroaryl" in claim 1 of the main request was to be interpreted as an unsubstituted group in line with T 177/08.

2.3 The board does not agree.

According to D12, heteroarenes are heterocyclic compounds formally derived from arene by replacement of one or more methine (-C=) and/or vinylene groups (-CH=CH-) by trivalent or divalent heteroatoms. According to D13, heteroaryl groups are derived from heteroarenes by removal of a hydrogen atom from any ring atom. The phenylbenzimidazolyl group of compound (3) of D2 is thus a substituted heteroaryl group. This was common ground between the parties.

The board agrees with the respondent that claim 1 defines radicals (R, R<sup>2</sup>, Ar<sup>3</sup>, Ar<sup>1</sup>, Ar<sup>2</sup>) which can have a substituent and a radical (L) which has no substituents. However, the claim does not make it clear whether or not the groups defined as the substituents can be substituted themselves. Therefore, in the absence of such information, the broadest reasonable interpretation of the claim is that its wording includes two implicit alternatives: the groups defined as the substituents have no substituent themselves (first alternative) or can be substituted themselves (second alternative). The expression contained in original claims 4, 5, 7 and 8 as invoked by the



respondent does not have any bearing on this interpretation of claim 1.

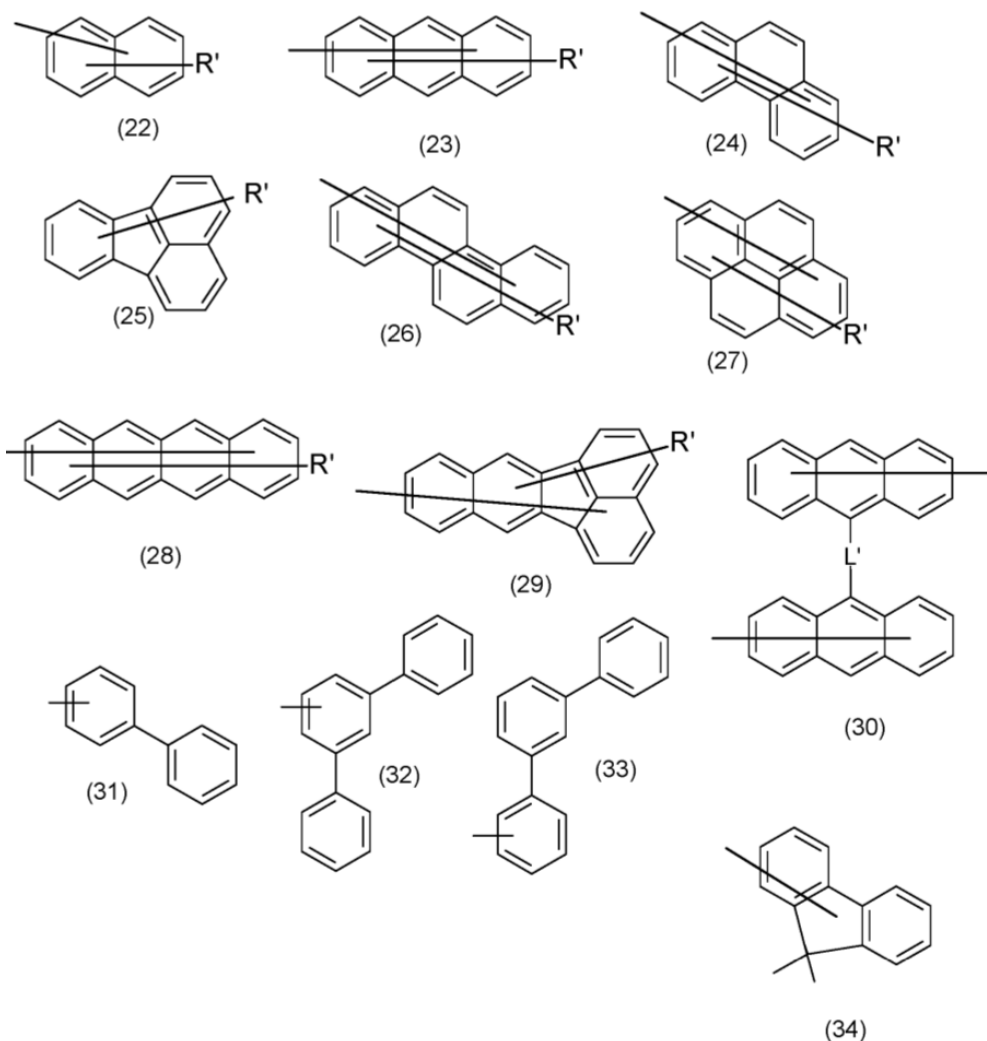
The skilled person would thus understand from the wording of claim 1 that, in the absence of a clear indication, the heteroaryl groups defined for the substituent of Ar<sup>3</sup> may be substituted. This interpretation of claim 1 of the main request does not contradict the definitions given by D12 and D13, since substituted heteroaryl groups still fall under the definition of heteroaryl groups as given in D13. Therefore, the phenylbenzimidazolyl group of compound (3) of D2 corresponds to a substituent of Ar<sup>3</sup>.

Furthermore, this interpretation of claim 1 of the main request is not in contradiction with T 177/08, referred to by the respondent, either. In said decision (reasons, 3.3), the meaning of an alkyl group was considered to be "*generally accepted, perfectly understandable per se, and unambiguously defined by IUPAC...*". For this reason, in the board's view, it did not need to be superseded by a different definition in the description. In the present case the term "heteroaryl" in claim 1 of the main request includes, in the absence of a clear indication in the claim, substituted heteroaryl groups, as defined by IUPAC and accepted in the art.

- 2.4 For the reasons given above, compound (3) of D2 falls within the definition of general formula (II) of claim 1 in the present case. The same holds true for the compound (2) disclosed in D4 (which is the same compound as compound (3) of D2). Consequently, the subject-matter of claim 1 lacks novelty over the disclosures of D2 and D4 (Articles 52(1) and 54 EPC). The main request is not allowable.

Auxiliary request 1 filed with letter of 18 March 2020

3. In claim 1 of auxiliary request 1, the definition of the radical  $Ar^3$  has been restricted when compared to claim 1 of the main request. In claim 1 of auxiliary request 1, the radical  $Ar^3$  "is a ring group represented by any of the following general formulae (22) to (34):

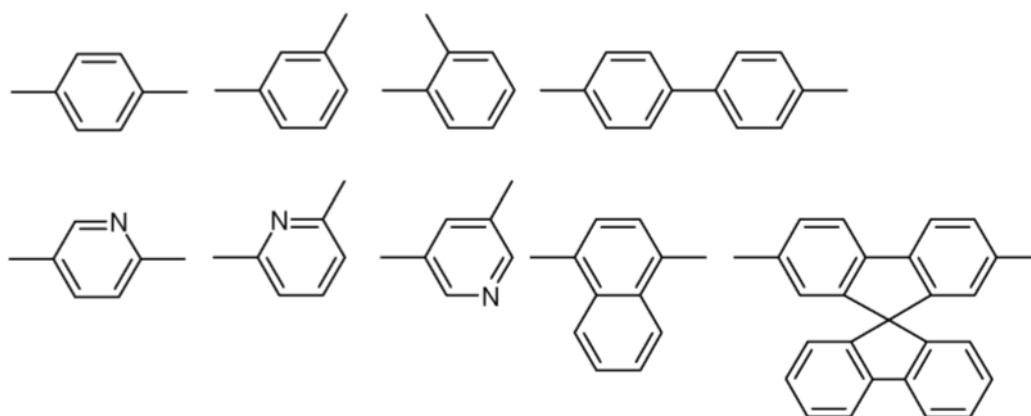


wherein each ring group may be bonded with a bonding group of a halogen atom, an alkyl group having 1 to 20 carbon atoms, an alkoxy group having 1 to 20 carbon atoms, an aryloxy group having 6 to 40 carbon atoms, an aryl group having 6 to 40 carbon atoms, or a heteroaryl group having 3 to 40 carbon atoms, and

the ring group does not have a substituent or the ring group has a substituent selected from the group consisting of an alkyl group having 1 to 20 atoms, an alkoxy group having 1 to 20 carbon atoms, an aryloxy group having 6 to 40 carbon atoms, a diarylamino group having 12 to 80 carbon atoms, an aryl group having 6 to 40 carbon atoms, and a heteroaryl group having 3 to 40 carbon atoms, and

when there are plural of bonding groups [sic], the bonding group may be the same or different with each other[sic];

L' represents a single bond or a group selected from the following groups:



wherein R' represents a hydrogen atom, an alkyl group having 1 to 20 carbon atoms, an aryl group having 6 to 40 carbon atoms, or a heteroaryl group having 3 to 40 carbon atoms, and

R' does not have a substituent, or R' has a substituent selected from the group consisting of an alkyl group having 1 to 20 atoms, an alkoxy group having 1 to 20 carbon atoms, an aryloxy group having 6 to 40 carbon atoms, a diarylamino group having 12 to 80 carbon atoms, an aryl group having 6 to 40 carbon atoms, and a heteroaryl group having 3 to 40 carbon atoms."

Alternatively, in claim 1 of auxiliary request 1, Ar<sup>3</sup> represents a group -Ar<sup>1</sup>-Ar<sup>2</sup> according to the same definitions as in claim 1 of the main request.

The appellant did not raise any objection against the claims of auxiliary request 1 based on Articles 84 and 123(2) EPC. The board, in turn, did not see any reason for raising objections in this regard either.

4. Novelty under Article 54 EPC

4.1 The appellant did not raise any novelty objection against claim 1 of auxiliary request 1.

4.2 The phenylbenzimidazolyl group of compound (3) of D2 and compound (2) of D4 having the formula depicted in point 2.1 above does not correspond to radical Ar<sup>3</sup> as defined in claim 1 of auxiliary request 1. The phenylbenzimidazolyl group is not a group of formulae (22) to (34) or a group -Ar<sup>1</sup>-Ar<sup>2</sup>. In particular, Ar<sup>2</sup> cannot be a heteroaryl group in claim 1 of auxiliary request 1.

4.3 Thus, the subject-matter of claim 1 of auxiliary request 1 is novel over the disclosure of either D2 or D4 (Article 54 EPC).

5. Inventive step under Article 56 EPC

5.1 The appellant objected to the inventive step of claim 1 of the main request in view of D6 or D5 taken as the closest prior art. Although the appellant did not raise any objection against auxiliary request 1, it requested revocation of the patent in its entirety. Therefore, the board understands that the inventive-step objections against claim 1 of the main request apply *mutatis mutandis* to the subject-matter of claim 1 of

any auxiliary request, hence also of auxiliary request 1.

## 5.2 Closest prior art

The compounds of claim 1 of auxiliary request 1 are nitrogen-containing heterocyclic derivatives. The patent aims to provide such compounds as constituent components of an organic EL device for achieving an increased luminance and efficiency in light emission under low driving voltage (paragraph [0001] of the patent).

D6 (claim 1 and paragraph [0007]) relates to EL devices comprising a nitrogen-containing heterocyclic compound and having a high intensity at a low driving voltage.

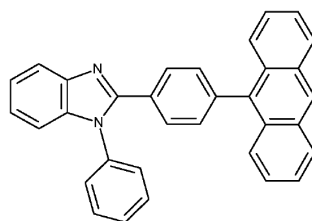
D5 (claim 1 and paragraph [0001]) discloses EL devices comprising a heterocyclic compound and having high brightness, high luminescence efficiency and excellent durability.

Each of D6 and D5 thus constitutes a suitable closest prior-art disclosure in the assessment of inventive step of the claimed subject-matter. The inventive step of claim 1 of auxiliary request 1 will be assessed below by applying the problem-solution approach starting from each document in turn.

*D6 as the closest prior art*

## 5.3 Distinguishing feature

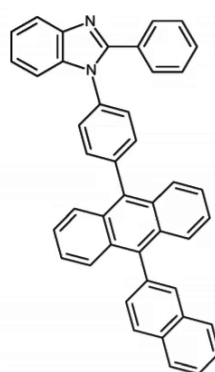
The appellant referred to compound 14 of D6 (paragraph [0052]) having the following formula:



The distinguishing feature of claim 1 of auxiliary request 1 in view of compound 14 of D6 is the substituent on the nitrogen atom at the position 1 of the benzimidazole, i.e. the radical  $-L-Ar^3$  in formula (II) of claim 1 of auxiliary request 1. In compound 14 of D6, this position 1 is substituted with a phenyl group.

#### 5.4 Formulation of the objective technical problem

The data presented in D14 show a higher value of the current efficiency at a driving voltage of 3V when compound ET-1, corresponding to compound (9-7) as defined in the patent (synthesis example 1; page 10, lines 20-25) and according to claim 1 of auxiliary request 1, is used instead of compound ET-2, corresponding to compound 14 of D6.



compound (9-7)

The current efficiency of compound ET-1 is 5.71 cd/A at a driving voltage of 3V and is higher than the value of 4.18 cd/A obtained for compound ET-2 under the same conditions. A higher current efficiency means a higher

luminance at the same driving voltage. It can thus be deduced that compound ET-1 achieves a higher luminance than compound ET-2.

The appellant submitted that it was known to the skilled person that structural modification of one compound led to unpredictable behaviours regarding the performance of the EL devices. The generalisation of the effect observed with compound (9-7) to all compounds encompassed by claim 1 was not credible. Therefore, the objective technical problem was only to provide an alternative compound.

The board does not agree. The appellant did not provide evidence for the allegation that the generalisation of the effect observed with compound (9-7) (compound of example 1, according to claim 1) to all compounds encompassed by claim 1 is not credible. Therefore, the appellant's assertion amounts to mere speculation, which is not sufficient to raise serious doubts, substantiated by verifiable facts, that the improved luminance could not be obtained with other compounds of formula (II) of claim 1.

Furthermore, there is no *prima facie* reason to doubt that the compounds of formula (II) achieve the same technical effect as that achieved by compound (9-7), i.e. that the technical effect shown is achieved across the whole claimed scope. Indeed, formula (II) of claim 1 of auxiliary request 1 covers compounds similar to compounds (9-7), all characterised by the same radical  $-L-Ar^3$ .

Considering the above, the objective technical problem is not the provision of an alternative compound in view of D6, as submitted by the appellant. Instead, it is seen as the provision of compounds that are suitable as

an electron injection or transport layer in an organic EL element leading to improved luminance at lower voltages.

#### 5.5 Obviousness

According to the appellant, the solution provided by claim 1 was obvious in view of D6 alone or in combination with D9 or D10, taking into consideration the common general knowledge represented by D7 and D8. It submitted that it would have been obvious to further substitute the phenyl ring of compound 14 of D6.

D6 taught further substituting the phenyl group in position 1 of the heterocyclic compound. This was evidenced by compound 38 (page 18), wherein the phenyl group in position 1 of the imidazole was further ortho-substituted by a phenyl group. Compound (9-7) would have been obtained by interchange of the substituents at the positions 1 and 2 of the benzimidazole moiety of compound 14 of D6 and further substitution of the anthracenyl group. The high reactivity of the anthracenyl group, which pertained to common general knowledge, as evidenced by D7 and D8, would deteriorate the luminance of the compound in EL devices. Therefore, the skilled person would have modified compound 14 of D6 by interchanging the substituents at the positions 1 and 2 of the benzimidazole moiety and further protecting the position 10 of the anthracenyl group. D9 would have been consulted, which disclosed e.g. in column 7 that 2-naphthyl substituents represented protecting groups for anthracene compounds. The same was disclosed in D10. This would have led the skilled person to arrive at compound (9-7) according to claim 1 of auxiliary request 1.

The board does not agree.



There is no teaching or motivation in D6 concerning how to improve the luminance at lower voltages of the nitrogen-containing heterocyclic compounds disclosed in the document, let alone how to structurally modify the compounds disclosed therein to improve the luminance at lower voltages.

D9 relates to organic EL elements comprising derivatives of anthracene. In particular, the derivatives of anthracene are disubstituted by naphthyl groups at the 9 and 10 positions (D9, column 7).

D10 also relates to organic EL elements comprising derivatives of anthracene. However, D10 was published on 17 November 2004, i.e. after the filing date of the application of the patent in suit (27 January 2004), and, for that reason, is not prior art according to Article 54(2) EPC which can be taken into account for the assessment of inventive step.

D7 is an extract from Wikipedia on anthracene. It shows, *inter alia*, the dimerisation of anthracene, which occurs at the 9 and 10 positions.

D8 discloses the reaction of bromine with anthracene leading to the formation of a 9,10-dibromoanthracene.

D7 and D8 constitute common general knowledge that the 9 and 10 positions of anthracene are particularly reactive.

However, there is no teaching in D9, even taking into consideration the common general knowledge constituted by D7 and D8, concerning how to structurally modify the nitrogen-containing heterocyclic compounds disclosed in D6 so as to improve luminance at lower voltages. Furthermore, there is no teaching in said prior art on how to structurally modify the heterocyclic compounds

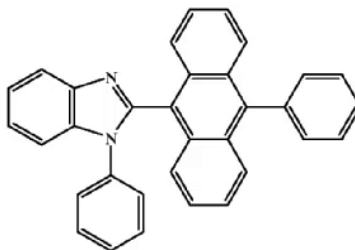
of D6 in order to avoid luminance deterioration, as submitted by the appellant. In said prior art, therefore, there is no evidence of a relationship between any structural modification of the heterocyclic compound of D6 and the luminance of an EL device comprising such a compound. In the absence of such a teaching, the skilled person would not have known how to modify compound 14 of D6 in order to solve the posed technical problem.

Therefore, the appellant's argument is based on hindsight and must thus fail.

*D5 as the closest prior art*

#### 5.6 Distinguishing feature

The appellant referred to compound 224 of D5 (page 43) having the following formula:



The distinguishing feature of claim 1 of auxiliary request 1 over this compound of D5 is the substitution on the nitrogen atom at the position 1 of the benzimidazole, i.e. the radical  $-L-Ar^3$  of formula (II) of claim 1 of auxiliary request 1. In compound 224 of D5, this position 1 is substituted with a phenyl group.

#### 5.7 Formulation of the objective technical problem.

Neither the patent nor the documents relied on by the parties comprise any comparative data showing that the

compound of claim 1 of auxiliary request 1 achieves a technical effect in comparison with compound 224 of D5.

Thus, the objective technical problem is the provision of alternative compounds for organic EL devices.

#### 5.8 Obviousness

The appellant only relied on D5 and submitted that, by exchanging the substituents in positions 1 and 2 of the benzimidazole derivative, the skilled person would have arrived at a compound according to claim 1 of auxiliary request 1. Such an exchange of substituents was a matter of routine experimentation for the skilled person.

The board does not agree with the appellant's argument.

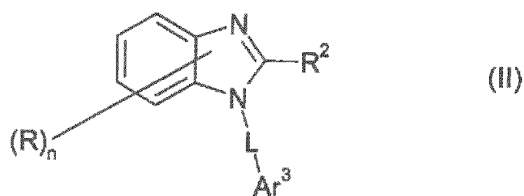
The compounds of formula (II) according to claim 1 of auxiliary request 1 are characterised by the radical  $-L-Ar^3$ . The appellant did not indicate what in D5 would have motivated the skilled person to modify compound 224 so as to arrive at the patent in suit, let alone to exchange the substituents in positions 1 and 2 of the benzimidazole ring of compound 224. The board sees no teaching and no motivation in this regard either in D5.

Furthermore, the appellant's approach is based on an ex post facto analysis, as the problem to be solved was not taken into consideration. It was not taken into consideration that the heterocyclic compounds had to be suitable for EL devices. The appellant did not indicate the passages in D5 that would have prompted the skilled person to perform the structural modification so as to arrive at the compounds of claim 1 of auxiliary request 1 with the expectation that the compounds would still be suitable for EL devices.

5.9 It follows that the subject-matter of claim 1, and by the same token of claims 2-12 of auxiliary request 1 referring back to the compound of claim 1, involves an inventive step within the meaning of Article 56 EPC.

6. Sufficiency of disclosure

6.1 Claim 1 of auxiliary request 1 relates to "A derivative of a heterocyclic compound having a nitrogen atom represented by the following general formula (II)



".

6.2 The appellant argued that the skilled person was faced with undue burden when trying to manufacture the claimed compounds in view of the huge number of compounds encompassed by claim 1. The compounds according to claim 1 comprised various positions that might be substituted and multiple possible substituents. The three examples of the patent could not be regarded as providing sufficient information so that all the compounds encompassed by claim 1 could have been prepared.

6.3 The board disagrees. According to established case law, a sufficiency-of-disclosure objection may only be raised if there are serious doubts, substantiated by verifiable facts. The mere fact that a claim is broad is not in itself a ground for considering that the claimed subject-matter lacks sufficiency of disclosure within the meaning of Article 83 EPC.

Example 1 of the patent allows the skilled person to prepare alternative benzimidazole derivatives of formula (II) by modifying/introducing substituents on the starting reactants as submitted by the respondent (see the reaction scheme at the bottom of page 2 of the reply to the statement of grounds of appeal). For instance, the amino-nitrobenzene, acyl chloride or boronic acid derivatives used as reactants in synthesis example 1 (paragraphs [0069], [0070], [0072] of the patent) may be further substituted, or equivalent reactants thereof may be used, in order to prepare substituted compounds of formula (II).

The appellant's submissions do not raise serious doubts, based on verifiable facts, that the invention as defined in claim 1 could not be carried out by a person skilled in the art without undue burden.

- 6.4 This position was already contained in the board's communication pursuant to Article 15(1) RPBA and was not contested by the appellant.
- 6.5 The board concludes that the invention as defined in the claims of auxiliary request 1 meets the requirements of Article 83 EPC.
7. In the absence of any further objections, the claims of auxiliary request 1 are allowable.

## Order

### For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the opposition division with the order to maintain the patent on the basis of the claims according to auxiliary request 1 as filed with letter dated 18 March 2020 and a description to be adapted thereto.

The Registrar:

The Chairman:



N. Maslin

M. Maremonti

Decision electronically authenticated