BESCHWERDEKAMMERN DES EUROPÄISCHEN PATENTAMTS

BOARDS OF APPEAL OF THE EUROPEAN PATENT OFFICE

CHAMBRES DE RECOURS DE L'OFFICE EUROPÉEN DES BREVETS

Internal distribution code:

(A) [-] Publication in OJ
(B) [-] To Chairmen and Members
(C) [-] To Chairmen
(D) [X] No distribution

Datasheet for the decision
of 12 July 2024

Case Number: T 2137/22 - 3.3.09

Application Number: 12735779.6

Publication Number: 2724388

IPC: H01L51/46, C07F9/06, C07F9/535, H01L27/30

Language of the proceedings: EN

Title of invention:
ELECTRONIC DEVICE

Patent Proprietor:
Novaled GmbH

Opponent:
Gleiss Große Schrell und Partner mbB

Headword:
Electronic Device/Novaled

Relevant legal provisions:
EPC Art. 56, 83
RPBA 2020 Art. 12(4), 12(6)

Keyword:

Inventive step - main request (yes)
Sufficiency of disclosure - main request (yes)
Amendment to case - admissibly raised and maintained (no)

Decisions cited:

Europäisches Patentamt
European Patent Office
Office européen des brevets

Beschwerdekammern

Boards of Appeal

Chambres de recours

Boards of Appeal of the
European Patent Office
Richard-Reitzner-Allee 8
85540 Haar
GERMANY
Tel. +49 (0)89 2399-0
Fax +49 (0)89 2399-4465

Case Number: T 2137/22 - 3.3.09

DECISION
of Technical Board of Appeal 3.3.09
of 12 July 2024

Appellant: (Patent Proprietor)	Novaled GmbH Elisabeth-Boer-Strasse 9 01099 Dresden (DE)
Representative:	Bittner, Thomas L. Boehmert & Boehmert Anwaltspartnerschaft mbB Pettenkoferstrasse 22 80336 München (DE)
Respondent: (Opponent)	Gleiss Große Schrell und Partner mbB Leitzstrasse 45 70469 Stuttgart (DE)
Representative:	Schrell, Andreas Gleiss Große Schrell und Partner mbB Patentanwälte Rechtsanwälte Leitzstrasse 45 70469 Stuttgart (DE)
Decision under appeal:	**Decision of the Opposition Division of the European Patent Office posted on 18 July 2022 revoking European patent No. 2724388 pursuant to Article 101(3)(b) EPC.**

Composition of the Board:

Chairman	N. Obrovski
Members:	C. Meiners M. Ansorge

Summary of Facts and Submissions

I. This decision concerns the appeal filed by the patent proprietor (appellant) against the opposition division's decision to revoke the patent in suit (the patent).

II. In its decision, the opposition division decided, *inter alia,* that the subject-matter of claim 1 of the main request filed by letter of 12 May 2021 was sufficiently disclosed (Article 83 EPC) but that it lacked an inventive step in view of document D2 as the closest prior art in combination with document D25. In an *obiter dictum*, the opposition division also considered the subject-matter of claim 1 to lack an inventive step over document D25 as the closest prior art in combination with document D2. The opposition division admitted documents D25 to D27 into the proceedings.

III. In its notice of opposition, the opponent had requested revocation of the patent on the basis of, *inter alia*, Article 100(a) EPC for lack of inventive step and Article 100(b) EPC for lack of sufficiency of disclosure.

IV. The following documents, filed in the opposition proceedings, are relevant to this decision:

D1 V.V. Guidi et al., "Bis(phospine Imide)s: Easily Tunable Organic Electron Donors", *The Journal of Organic Chemistry* 70, 2005, 7737-43

D2 M. Escobar et al., "Electron-Donating Properties of p-Phenylene Phosphine Imides: An Electrochemical and Spectroscopic Investigation", *Organic Letters* 42(13), 2002, 2213-6

D3 K. Walzer et al., "Highly Efficient Organic Devices Based on Electrically Doped Transport Layers", *Chemical Reviews* 107, 2007, 1233-71

D4 US 2007/0145355 A1

D25 US 2010/0147386 A1

D26 Experimental report on TTF in solar cell processing, filed by the proprietor Novaled GmbH, 24 March 2022

D27 Experimental data "Concentration variation of compound 4", filed by the opponent by letter dated 4 April 2022

V. The board issued a communication pursuant to Article 15(1) RPBA (the communication) in which it detailed its preliminary opinion on the relevant issues to be discussed at the oral proceedings before the board.

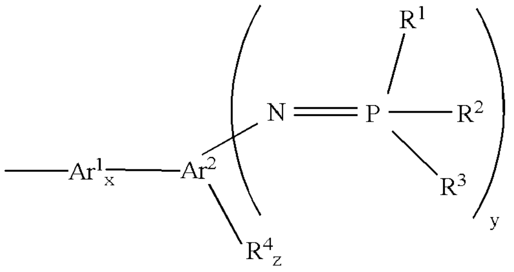
VI. Claim 1 of the main request reads:

"Electronic device comprising an n-dopand according to formula 1

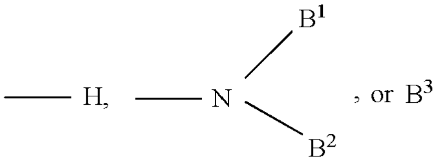
$$A-B \quad (1),$$

wherein

B =



A =



and wherein

- Ar^1 is a C6-C18 arylene, which can be monocyclic or polycyclic and may be optionally substituted by one or more C_1-C_{10}-alkyl or C_3-C_{10}-cycloalkyl groups,
- Ar^2 is a C6-C18 arene skeleton, optionally substituted with electron donating groups R^4,
- B^1 and B^2 are independently selected from B and Ar^2,
- B^3 is independently selected from the same group as B
- R^1, R^2, R^3 are independently selected from alkyl, arylalkyl, cycloalkyl, aryl, dialkylamino,
- x is selected from 0, 1, 2 and 3, wherein for $x > 1$ each Ar^1 may be different,
- y is a non-zero integer up to the overall count of valence sites on the arene skeleton,
- z is a integer from zero up to the overall count of valence sites on the arene skeleton minus y;

wherein the electronic device is a solar cell."

VII. The patent proprietor's (appellant's) arguments relevant to the present decision can be summarised as follows.

(a) The subject-matter of the main request was sufficiently disclosed and could be carried out by a skilled person over the whole area claimed without undue burden. Selecting suitable n-dopant compounds (1) for a given matrix material did not pose a problem to a skilled person. Likewise, methods for determining reduction potentials of the matrix material were known to a skilled person. In this regard, paragraph [0033] of the patent provided sufficient information. The cyclic voltammetry (CV) measurements in the patent had been accomplished using dichloromethane as a solvent. What was more, a skilled person would have no difficulty in selecting suitable p-dopants when wishing to reduce the claimed solar cells to practice.

(b) The subject-matter of the main request involved an inventive step in view of D1, D2 or D25 as the closest prior art. Document D2, however, was not a suitable starting point for the assessment of inventive step as it was not directed to a similar purpose as addressed by the claimed subject-matter. Similarly, D1 was not the closest prior art either. By contrast, D25 related to solar cells and mentioned electron transport layers (ETLs) comprising n-dopants. Starting from D25 as the closest prior art, the distinguishing feature in claim 1 was the n-dopant compound (1). In light of the data provided in D26, the resulting objective technical problem was to improve the performance of a solar cell. Even if a skilled person had chosen tetrathiafulvalene (TTF) in D25 as an n-dopant, they would have abstained from testing further compounds similar to TTF. The reason was that TTF was not suitable for vacuum deposition. Moreover, the improved solar cell performance achieved by the claimed subject-matter was not derivable from D2. D2 did not even provide an incentive to consult it and combine its disclosure with the teaching of D25. Consequently, the claimed subject-matter was not obvious to a skilled person and met the requirement of Article 56 EPC.

VIII. The opponent's (respondent's) arguments relevant to the present decision can be summarised as follows.

(a) The invention was insufficiently disclosed. The patent did not disclose how it should be established whether or not a given compound of formula (1) acts as an electron donor and thus as an n-donor compound. This held particularly true since the patent did not disclose any standard matrix in which the compound should act as a dopant. Similarly, paragraph [0051] of the patent suggested that the compound of formula (1) could also act as an acceptor compound. No specific test methods for determining the potentials of the compounds and their electrical conductivity were described in the patent either. It was not clear either whether the potentials disclosed in e.g. paragraph [0054] were oxidation, reduction or redox potentials. Likewise, no solvent was indicated in the patent for carrying out the CV measurements. What is more, the examples of the patent could not be reworked since the nature of the p-dopants was not indicated. Consequently, the requirement of Article 83 EPC was not met by the claimed subject-matter.

(b) The subject-matter of claim 1 lacked an inventive step in view of each of documents D2 and D25.

The distinguishing feature in view of D2 was the specific optoelectronic use of the compound in a solar cell. In view of the better electron donor properties of compound (1) compared with TTF, the skilled person would have been prompted by the teaching of D25 to use compound (1) as an n-dopant material in solar cells. They would thus have arrived at the subject-matter in an obvious way.

The distinguishing feature of claim 1 over D25 was the use of a compound of formula (1) instead of, for instance, TTF. No technical effect had been demonstrated that could be associated with this difference. The objective technical problem was thus to provide a solar cell doped with an alternative n-dopant. In view of the good electron donor properties and air stability of compound (1) of D2, the latter document prompted the skilled person to use compound (1) instead of e.g. TTF as an n-dopant in solar cells as described in D25.

Similarly, the subject-matter of claim 1 lacked an inventive step in view of document D1 as alternative closest prior art. *Inter alia*, claim 1 was not restricted to ETLs. Hence, the distinguishing feature was merely that the use of compounds of formula 1 of claim 1 in solar cells was not explicitly mentioned in D1. No unexpected technical effect had been demonstrated that could be ascribed to the distinguishing feature. Therefore, the subject-matter of claim 1 was obvious.

Hence, the subject-matter of claim 1 lacked an inventive step in view of D1, D2 or D25.

IX. *Requests*

The appellant requested that the decision under appeal be set aside and that the patent be maintained on the basis of the main request, filed with the statement of grounds of appeal.

The respondent requested that the appeal be dismissed.

Reasons for the Decision

1. *Sufficiency of disclosure - main request*

1.1 At the oral proceedings before the board, the parties referred to their written submissions on sufficiency of disclosure. The board thus saw no reason to deviate from its preliminary assessment outlined in the board's communication, which is therefore essentially reproduced in the following.

1.2 To meet the requirement of sufficiency of disclosure, an invention has to be disclosed in a manner sufficiently clear and complete for it to be carried out by the skilled person without undue burden on the basis of the information provided in the patent specification and, possibly, common general knowledge.

1.3 As stated by the opposition division in its decision, a person skilled in the art would be in the position to measure the reduction potentials of compounds of formula (1) and of the matrix materials under comparable conditions using cyclic voltammetry (CV). It is also indicated in the patent that dichloromethane was employed for the CV experiments. Likewise, the redox pair ferrocene/ferrocenium is used as a reference in the electrochemical potential determination (see paragraph [0033] of the patent and examples).

1.4 A person skilled in the art could also repeat the CV measurements in dichloromethane with the compounds described in the examples to establish whether (in line with the teaching of paragraph [0033]) reduction potentials have been determined.

1.5 Hence, a person skilled in the art would have no difficulty in establishing the relevant highest occupied molecular orbital (HOMO) and lowest unoccupied molecular orbital (LUMO) levels of the materials. By doing so and using common general knowledge, a person skilled in the art would be able to assess whether a given phosphine imide (1) can be expected to act as an electron donor for a given matrix compound. In the same way, a person skilled in the art would know suitable standard methods for determining the conductivity of (organic) layers.

1.6 The respondent also mentioned that the calculation of HOMO energy levels is common general knowledge. This statement supports that a person skilled in the art would be in a position to select suitable candidates for achieving n-doping of matrix materials. This n-doping is required by claim 1.

1.7 Insufficiency of disclosure does not arise from the fact that the p-dopants in devices 2 and 3 featured in the patent are not known. A person skilled in the art would not have had any difficulty in selecting suitable p-dopants for hole transport layer materials. This is also reflected by the teaching of document D3.

For the reasons provided in point 4 of the decision under appeal, the board therefore endorses the opposition division's positive assessment of sufficiency of disclosure of the subject-matter of claim 1.

2. *Inventive step - main request*

2.1 The patent relates to organic solar cells and in particular ETLs forming part of such devices (see paragraphs [0001], [0002], [0034] and [0035]; examples; and claim 1). It is common ground between the parties that the "n-dopant" referred to in claim 1 is a material mixed with a matrix material which is an electron transport material (see paragraph [0034] of the patent). By donating electrons to the matrix, it increases the electrical conductivity of the matrix material.

2.2 Suitable starting points

2.2.1 It is established case law of the boards of appeal that the most promising starting point (usually referred to as the closest prior art) for assessing inventive step is normally a prior-art document that discloses subject-matter conceived for the same purpose or aiming at the same objective as the claimed invention and having the most relevant technical features in common. A further criterion for the selection of the most promising starting point is the similarity of the technical problem. A "bridgehead" position should be selected, which the skilled person would have *realistically* taken under the circumstances of the claimed invention. Among these circumstances, aspects such as the designation of the subject-matter of the invention, the formulation of the original problem and the intended use, and the effects to be obtained should generally be given more weight than the maximum number of identical technical features (see Case Law of the Boards of Appeal, tenth edn., 2022, I.D.3.1).

2.2.2 As correctly noted by the respondent, the decision under appeal is not based on document D1 as a suitable starting point. Furthermore, in point 4 of the minutes of the oral proceedings before the opposition division, the following is stated: "The chairperson asked the parties to argue on which documents are feasible candidates for the closest piece of prior art. The opponent argued that both documents D2 and D25 could be considered as the closest prior art." This excludes considering document D1 as the closest piece of prior art. Hence, the opponent did not maintain this objection in the oral proceedings before the opposition division. At the oral proceedings before the board, the respondent merely referred to its submissions in the written proceedings and did not provide any comments on admittance.

The decision under appeal was not based on this objection within the meaning of Article 12(2) RPBA, and it was not (admissibly raised and) maintained in the proceedings leading to the decision under appeal within the meaning of Article 12(4) RPBA. Hence, the respondent's objection based on document D1 qualifies as an amendment under Article 12(4) RPBA. In addition, the objection was no longer maintained in the proceedings leading to the decision under appeal within the meaning of Article 12(6), second sentence RPBA. Article 12(6), second sentence RPBA is in its scope of application narrower than Article 12(4) RPBA, and the bar for admitting a submission under Article 12(6), second sentence RPBA is higher than under Article 12(4)

RPBA ("shall not admit [...] unless" versus "admitted only at the discretion"). Therefore, Article 12(6), second sentence RPBA is a *lex specialis* to Article 12(4) RPBA and must be applied as the more specific rule.

If a submission is not maintained in the proceedings leading to the decision under appeal, the department of first instance cannot give a reasoned decision on this issue which could be reviewed by the board. Hence, admitting the inventive step objection based on document D1 would have been at odds with the primary object of the appeal proceedings to review the decision under appeal in a judicial manner, which is explicitly stated in Article 12(2) RPBA and, as an underlying principle, also relevant for Article 12(6), second sentence RPBA. Admitting this objection would also have run contrary to the requirement of procedural economy, which is an overarching legal principle underlying the rules on late-filed submissions.

Furthermore, there are no circumstances of the appeal case which could justify the admittance of this objection within the meaning of Article 12(6), second sentence RPBA. The main request in the appeal proceedings corresponds to the main request in the opposition proceedings. Hence, it cannot be said that the *prima facie* relevance of this objection - which may have influenced the respondent's decision not to maintain the objection (the opposition division's preliminary assessment of the inventive-step objection based on document D1 prior to the oral proceedings before it having been negative) - has objectively changed in the appeal proceedings because a different set of claims must be considered. For completeness, the board further notes that the objection is *prima facie* not relevant either. D1 proposes the use of the phosphine imides as a hole transport material in hole transport layers (HTLs) and not as an n-dopant for an electron transport matrix (ETM) material. The board considers that a person skilled in the art would not interpret HTLs of solar cells as layers in which an n-dopant improves electron conductivity of an ETM material, as referred to in paragraph [0034] of the patent. Similarly, paragraph [0050] of the patent discloses the use of the compounds of formula (1) in an ETL.

Hence, the board did not admit the inventive-step objection starting from document D1 into the appeal proceedings under Article 12(6), second sentence RPBA.

2.2.3 At the oral proceedings before the board, the parties referred to their written submissions on whether document D2 constitutes a suitable starting point for the assessment of inventive step. Thus, the board saw no reason to deviate from its preliminary opinion outlined in the board's communication regarding this matter, which is essentially reproduced below.

2.2.4 Document D2 *neither addresses the technical field of solar cells nor features the ETLs of optoelectronic devices*. Instead, D2 describes (organic) *conjugated polymers* and organic donor-acceptor *complexes* using typically tetrathiafulvalenes (TTFs) as an electron donor as two areas. As stated in the board's communication, D2 mentions on page 2213 that *conjugated polymers* (rather than referring to donor-acceptor complexes) have a variety of applications, including light-emitting diodes.

2.2.5 Similarly, D2 mentions "conjugated polymers and related organic donor acceptor complexes" in the paragraph bridging the right- and left-hand column on page 2213. Furthermore, D2 states in that paragraph that "there have been significant recent efforts to *couple* the two related areas via the preparation of conjugated polymers that incorporate π-donors or acceptors and conjugated oligimers *[sic]* capped with electron-withdrawing or electron-donating groups". The two related areas referred to are the aforementioned ones, referred to in point 2.2.4 above.

2.2.6 Tetracyanoquinodimethane (TCNQ), an electron acceptor compound used in charge-transfer complexes with TTF is explicitly mentioned in D2 in this regard. TTF is not described in D2 in the context of an ETL, let alone as one to be used in solar cells or light-emitting diodes. As stated in the board's communication, D25 (a document in which the use of TTF in an ETL is proposed) does not reflect the common general knowledge on solar cells but is used by the opponent as a complementary/secondary technical teaching in view of D2 as the closest prior art. D25 is not a part of the disclosure of D2 either.

2.2.7 Compound (1) of D2, a phosphine imide falling within the scope of formula (1) in claim 1, is discussed in D2 as a *model compound* for the hardly soluble donor-acceptor *polymers* featured in D2 (see Scheme 1). In this regard, compound (1) is not a monomer leading to the polymers of D2 either. D2 focuses on the development of more soluble variants of such polymers by incorporating flexible alkoxy substituents.

2.2.8 With D2 not being directed towards solar cells or mentioning the purpose of providing the ETL of electronic devices, let alone for solar cells, it is not a realistic or suitable starting point for the assessment of inventive step, meaning that it can be concluded at this stage of the problem-solution approach that the opponent's line of attack based on D2 does not render the subject-matter of claim 1 obvious.

2.2.9 Both parties in the appeal proceedings consider that document D25 is a suitable starting point. As that document addresses the same purpose as the patent and in particular claim 1 of the main request, i.e. the provision of solar cells, the board sees no reason to deviate from this assessment.

2.3 Distinguishing feature

The solar cells featured in D25 comprise ETLs ("interfacial modification layers") which contain an organic matrix material doped with an n-dopant. The dopant used in the examples of D25 is a metal (see e.g. Table 3). This seems to correspond to the first approach mentioned on page 1244 of D3. Alternative n-dopant materials mentioned in D25 are organic dopants such as TTF (see paragraphs [0062] and [0069] of D25). The subject-matter of claim 1 differs from D25 in that it does not disclose an n-dopant according to formula 1 defined in claim 1.

2.4 Technical effect and objective technical problem

2.4.1 Compared with TTF as an n-dopant, compounds falling within the scope of formula (1) of claim 1 showed improved device efficiencies and improved processing properties in the comparative tests described in D26. In this context, the interfacial modification layers (IMLs) of D25 are deposited by *co-evaporation* of the materials (see paragraph [0069]). There is no information at hand that, compared with TTF, embodiments of claim 1 would act as an inferior n-dopant under comparable conditions (including a comparable molar ratio of dopant to matrix).

2.4.2 The respondent argued that in D27, at a dopant level of 0.7 mol% of compound 4, no working solar cell had been obtained. This showed that the alleged technical effect could not be obtained over the whole scope claimed.

As to this point, the board considers that a dopant level that does not achieve charge transport and the functioning of the device as a solar cell would not be considered by a person skilled in the art. The claimed subject-matter is directed towards a solar cell, which the skilled person understands to have to act as such.

2.4.3 Likewise, the respondent stated that the data in D26 related to compound 4 rather than compound 1 as specified in the patent. The data in D26 thus could not demonstrate a technical effect obtained vis-à-vis the prior art, which disclosed compound 1 in document D2.

In view of the similar molecular structure and oxidation potential of compounds 1 and 4, the results shown in D26 render it credible that the improvements shown compared to TTF would also be observed for compound 1. The latter material also gave good results in terms of power conversion efficiency in tandem solar cells (see paragraph [0081] of the patent). Likewise, additional examples provided by letter of 4 February 2022, which are also reproduced in Table 3 of the statement of grounds of appeal, support that compound 1 shows comparable or even better fill factors and device efficiencies when compared with compound 4.

There is thus no reason to doubt that compound 1 also exceeds TTF as an n-dopant in solar cells.

2.4.4 The respondent also stated that the appellant itself had argued that TTF was not processable. It had thus not been demonstrated that the same molar concentration of that compound as compound 4 had been used in the experiments featured in D26. The board agrees with the appellant that this objection, i.e. that in the deposition of TTF in D26 the amount of TTF in the ETLs of D26 was not certain in view of the sublimation of part of the TTF onto the line rather than in the layer system, is an unsubstantiated allegation.

2.4.5 The *objective technical problem* vis-à-vis D25 using TTF can thus be formulated as to provide a solar cell having *improved ETL materials* having also *improved processing properties*. The latter aspect was also addressed by the board at the oral proceedings. The data provided in D27 support that a compound falling within the scope of claim 1 acts as an efficient n-dopant when used in ETLs of solar cells.

2.5 Obviousness

2.5.1 In view of the explanations provided in point 2.2.2 of D3, the provision of a suitable n-type dopant for ETLs of optoelectronic devices is a demanding exercise. The organic compounds used in this context in the prior art differ markedly in structural terms from phosphine imides (see section 2.2.2 of the review article D3, paragraph [0008] of the patent, and paragraphs [0062] and [0069] of D25).

2.5.2 D2 does not provide the missing link since it does not disclose or suggest the use of phosphine imides in accordance with formula 1 of claim 1 in ETLs of optoelectronic devices, let alone of solar cells. By contrast, D2 focuses on the development of donor acceptor-type *conjugated polymers* (instead of an electron charge transport layer for solar cells). In the board's view and in contrast to the respondent's argument, D2 aims at *coupling* the two areas of donor-acceptor complexes and conjugated polymers. Hence, the respondent's argument that D2 proposed exploring two separate concepts in a "pioneer area", namely single molecule compound (1) and conjugated polymers, does not hold.

2.5.3 The respondent argued that D2 discloses better electron donor properties than TTF, stability upon exposure to atmospheric conditions for several hours, and reaction with TCNQ in liquid and solid systems and that compound (1) possessed many characteristics of electron donors in organic conductive solids. In view of this, the skilled person knew that also the single molecule compound (1) (and not only conjugated polymers) could equally be used in optoelectronic applications. The respondent also mentioned that TCNQ was shown as an electrophilic matrix material for solar cells in Figure 14 of D3.

2.5.4 However, this use in optoelectronic applications is not stated in D2 and does not alter that D2 aims at combining the aforementioned two areas to provide conjugated polymers. D2 merely states in that passage referred to by the respondent: "Conjugated polymers have a wide variety of optoelectric applications including sensors, light emitting diodes (LEDs) and nonlinear optical materials." Compound (1) of D2, falling within the scope of formula (1) in claim 1, is discussed in D2 as a model compound for the hardly soluble donor-acceptor polymers featured in D2 (see Scheme 1). In this regard, compound (1) is not a monomer leading to the polymers of D2 either.

2.5.5 Moreover, a lower electron affinity of a potential electron donor relative to a point of comparison/ material exhibiting a higher electron affinity is not "synonymous" with improved solar cell performance. The teaching that compound (1) in D2 is a better electron donor than TTF thus does not necessarily transform into improved device efficiency and fill factor in solar cells (see the results obtained in the patent with even stronger dopants and in D26 with TTF vs compounds of claim 1). It is not at odds with that conclusion that greater electron donor properties of the n-dopant in the ETL is a factor in favour of increased electron transport in the ETL.

The fact that documents D3 and D4 teach that the HOMO levels of both TTF and compounds in accordance with formula 1 of claim 1 would render them (principally) inherently suitable for use as n-dopants in solar cells does not change the above conclusions.

2.5.6 Likewise, the respondent has not provided persuasive arguments in favour of the obviousness of improved processability as a further aspect that in the board's view can be associated with the claimed subject-matter, relying on n-dopants of formula 1. As stated above, the ETL/IMLs of D25 are prepared by *co-evaporation* of the layer components. In this regard, the appellant convincingly argued that the skilled person confronted with such a failure using TTF as a material to be deposited in the ETL/IML would decide to adhere to solutions exemplified in D25 "that work". This would mean using metals as n-dopant materials in the IMLs, exemplified in the examples, rather than seeking modifications and consulting secondary information sources such as D2 or D1. Pursuing such modifications would require either directly looking for other organic n-dopant compounds that show better processability than TTF or first exploring other preparation methods for the ETL/IML not applied in D25 in the preparation of ETL/IMLs to deposit TTF and then searching for a substitute for TTF. Neither is something the skilled person would have done in view of the solutions exemplified in D25 and its disclosure of IML/ETL preparation by co-evaporation. For this reason alone, the subject-matter of claim 1 is not obvious.

2.5.7 In view of the above reasoning, based on document D25 as the most promising starting point, the alleged "try-and-see" situation referred to by the respondent at the oral proceedings in light of the teaching of D2 is tainted by hindsight. The respondent based this alleged "try-and-see" situation on the disclosure of compound (1) in D2, its suitability for use in optoelectronic devices that could also be solar cells, the comparison between compound (1) with TTF and the lower oxidation potential of compound (1) compared with TTF. The air stability of compound (1) and that compound (1) possesses many characteristics of electron donors in organic conductive solids were also mentioned by the respondent as alleged pointers to the suitability of that compound as an electron donor in ETLs of devices as claimed.

However, as correctly pointed out by the appellant, D2 does, firstly, not mention the preparation of ETLs for solar cells (or, for that matter, solar cells at all) and thus, secondly, cannot report on problems of processing TTF as an n-dopant material for ETLs or that compound (1) is suitable for co-evaporation as the deposition method for the preparation of IML/ETLs in D25. Hence, D2 would not realistically prompt the skilled person to modify the teaching of D25 to arrive at the subject-matter in an obvious way.

2.5.8 The respondent referred in passing to document D1 as a secondary information source in the reply to the appeal. However, the attacks based on document D1 as a secondary source of information in the reply to the appeal are not persuasive and do not convince the board. It follows from the above in point 2.2.2 that D1 proposes to use compounds encompassed by formula (1) of claim 1 as a hole transport material in HTLs and not as an n-dopant for an ETM material.

2.5.9 The subject-matter of claim 1 is thus not obvious to a person skilled in the art in view of D25.

2.6 For these reasons, the subject-matter of claim 1 meets the requirement of Article 56 EPC. The dependent claims share the feature combination of claim 1 and thus equally involve an inventive step.

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 with the following claims and a description to be adapted:
   - claims 1 to 13 of the main request filed with the statement of grounds of appeal

The Registrar: The Chairman:

Beschwerdekammern des Europäischen Patentamts ✦ Boards of Appeal of the European Patent Office ✦ Chambres de recours de l'Office européen des brevets

K. Götz-Wein N. Obrovski

Decision electronically authenticated