Datasheet for the decision
of 15 March 2016

Case Number: T 2623/11 - 3.4.03
Application Number: 06113853.3
Publication Number: 1732149
IPC: H01L51/10
Language of the proceedings: EN

Title of invention:
Barrier layer for an organic electronic device

Applicant:
Xerox Corporation

Headword:

Relevant legal provisions:
EPC 1973 Art. 54(1), 56, 84
EPC Art. 69(1)
RPBA Art. 13(1)

Keyword:
Novelty - (no)
Inventive step - (no)
Clarity - (no)
Article 69(1) EPC not applicable
Decisions cited:

Catchword:
Case Number: T 2623/11 - 3.4.03

DECISION of Technical Board of Appeal 3.4.03 of 15 March 2016

Appellant: Xerox Corporation
(Applicant)
Xerox Square - 20A
Rochester, NY 14644 (US)

Representative: Grünecker Patent- und Rechtsanwälte
PartG mbB
Leopoldstraße 4
80802 München (DE)

Decision under appeal: Decision of the Examining Division of the European Patent Office posted on 22 July 2011 refusing European patent application No. 06113853.3 pursuant to Article 97(2) EPC.

Composition of the Board:

Chairman G. Eliasson
Members: R. Bekkering
T. Bokor
Summary of Facts and Submissions

I. The appeal is against the refusal of application No. 06 113 853 for lack of novelty, Article 54(1) EPC (main request) over document:

D5: US 2004/0222412 A

and for lack of an inventive step, Article 56 EPC (auxiliary request) over document D5 and document:

D1: US 2004/0245541 A.

II. A summons to oral proceedings appointed for 15 March 2016 was issued by the board, provided with an annexed communication in which a provisional opinion of the board on the matter was given.

In particular, the appellant was informed that it appeared that the subject-matter of claim 1 according to the main request lacked novelty in the sense of Article 54(1) EPC 1973 over document D5 and, furthermore, lacked an inventive step in the sense of Article 56 EPC 1973 over document D1 and common general knowledge.

Claim 1 according to the first and third to fifth auxiliary request were considered to lack clarity, Article 84 EPC 1973.

The subject-matter of claim 1 according to the second auxiliary request appeared to lack an inventive step in the sense of Article 56 EPC 1973 over documents D1, D5 and document
D2: WO 2004/009720 A.

III. At oral proceedings before the board, the appellant requested that the decision under appeal be set aside and that a patent be granted on the basis of the claims according to the main request or the first to fifth auxiliary request filed with the statement setting out the grounds of appeal dated 1 December 2011, or according to the sixth to ninth auxiliary request filed with letter of 11 December 2015.

IV. Claim 1 according to the main request reads as follows:

"An organic thin film transistor comprising a substrate, a gate electrode, a dielectric layer, a source electrode, a drain electrode, a semiconductor layer and a barrier layer, wherein the barrier layer comprises a polymer, an antioxidant, and an inorganic particulate material."

V. Claim 1 according to the first auxiliary request reads as follows:

"An organic thin film transistor comprising a substrate, a gate electrode, a dielectric layer, a source electrode, a drain electrode, a semiconductor layer and an encapsulation layer, wherein the barrier layer comprises a polymer, an antioxidant, and an inorganic particulate material."

VI. Claim 1 according to the second auxiliary request reads as follows:

"An organic thin film transistor comprising a substrate, a gate electrode, a dielectric layer, a
source electrode, a drain electrode, a semiconductor layer and a barrier layer, wherein the barrier layer comprises a polymer, an antioxidant being 2-hydroxy-4-octyloxybenzophenone, and an inorganic particulate material being surface-modified aluminum oxide (Al₂O₃)."

VII. Claim 1 according to the third auxiliary request reads as follows:

"An organic thin film transistor comprising a substrate, a gate electrode, a dielectric layer, a source electrode, a drain electrode, a semiconductor layer and an encapsulation layer, wherein the barrier layer comprises a polymer, an antioxidant being 2-hydroxy-4-octyloxybenzophenone, and an inorganic particulate material being surface-modified aluminum oxide (Al₂O₃)."

VIII. The claims according to the fourth auxiliary request comprises three independent claims which read as follows:

"1. An organic thin film transistor comprising, in order, a substrate, an optional gate electrode, a dielectric layer, a source electrode, a drain electrode, an organic semiconductor layer and an encapsulation layer, wherein the encapsulation layer comprises a polymer, an antioxidant and an inorganic particulate material.

2. An organic thin film transistor comprising, in order, a substrate, an optional gate electrode, a dielectric layer, an organic semiconductor layer, a source electrode, a drain electrode, and an encapsulation layer, wherein the encapsulation layer
comprises a polymer, an antioxidant, and an inorganic particulate material.

3. An organic thin film transistor comprising, in order, a substrate, a source electrode, a drain electrode, a dielectric layer, an organic semiconductor layer, a gate electrode, and an encapsulation layer, wherein the encapsulation layer comprises a polymer, an antioxidant, and an inorganic particulate material."

IX. The claims according to the fifth auxiliary request correspond to those according to the fourth auxiliary request with the expression "an optional gate electrode" in claims 1 and 2 being replaced by "a gate electrode".

X. Claim 1 according to the sixth auxiliary request corresponds to claim 1 of the first auxiliary request with the expression "wherein the barrier layer comprises" being replaced by "wherein the encapsulation layer comprises".

XI. Claim 1 according to the seventh auxiliary request corresponds to claim 1 of the third auxiliary request with the expression "wherein the barrier layer comprises" being replaced by "wherein the encapsulation layer comprises".

XII. The claims according to the eighth auxiliary request comprises three independent claims which read as follows:

"1. An organic thin film transistor comprising a substrate, an optional gate electrode, a dielectric layer, a source electrode, a drain electrode, an organic semiconductor layer and, deposited on said
organic semiconductor layer and in contact therewith, an encapsulation layer, wherein the encapsulation layer comprises a polymer, an antioxidant, and an inorganic particulate material.

2. An organic thin film transistor comprising, in order, a substrate, an optional gate electrode, a dielectric layer, an organic semiconductor layer, a source electrode, a drain electrode, and an encapsulation layer, wherein the encapsulation layer comprises a polymer, an antioxidant, and an inorganic particulate material.

3. An organic thin film transistor comprising, in order, a substrate, a source electrode, a drain electrode, a dielectric layer, an organic semiconductor layer, a gate electrode, and an encapsulation layer, wherein the encapsulation layer comprises a polymer, an antioxidant, and an inorganic particulate material."

XIII. The claims according to the ninth auxiliary request correspond to those according to the eighth auxiliary request with the expression "an optional gate electrode" in claims 1 and 2 being replaced by "a gate electrode".

XIV. The appellant submitted in substance the following arguments:

Document D5 related to an electronic device comprising an organic polymer dielectric layer, optionally including additional additives such as fillers and antioxidants. Document D5 did not relate to a layer as a barrier.

...
Furthermore, D5 did not refer to a layer specifically comprising a combination of a polymer, an antioxidant and an inorganic particulate material.

Accordingly, the subject-matter of all claims was novel over document D5.

Document D1 related to a light-emitting device having an organic light-emitting element and a sealing agent comprising an ultraviolet absorbent dispersed in an ultraviolet curable resin. Suitable UV absorbents included for example benzophenone-based UV absorbents. Moreover, also porous materials such as zeolite, or deoxidizing materials, such as fine particles of a metal could be used. Therefore, D1 suggested the inorganic particle material as an alternative to other UV absorbents, but did not unambiguously disclose or even suggest that the barrier layer had to comprise all three components, a polymer, an antioxidant and an inorganic particulate material, at the same time.

Accordingly, the claims also involved an inventive step.

As regards the clarity objections, according to established case law of the Technical Boards of Appeal of the EPO, and further according to Article 69 EPC, the claims should be interpreted in the light of the description and figures. Although Article 69 EPC related to the scope of protection of the claims, the same principle also applied to the clarity of the claims under Article 84 EPC.

Regarding the first and third auxiliary request, it was evident from the description that the expressions "barrier layer" and "encapsulation layer" were used
interchangeably throughout the application. Accordingly, it was readily apparent that the terms "encapsulation layer" and "barrier layer" referred to in claim 1 related to the same feature. Accordingly, the claims were in accordance with the requirements of clarity under Article 84 EPC.

Regarding the fourth and fifth auxiliary request, it was re-emphasized that the claims should be interpreted in the light of the description and figures. It was immediately evident to a skilled person, especially on the basis of the figures provided with the application, that the "order" of layers recited in claim 1 related to the stacking of the layers on top of each other. The stacking of drain and source electrodes on top of each other would not be in accordance with the skilled person’s general knowledge of how to arrange the respective layers disclosed in the TFT of claim 1, as such an arrangement did not make technical sense, and would therefore be ruled out.

Accordingly, the claims of the fourth and fifth auxiliary request were in accordance with the requirements of clarity under Article 84 EPC.

The sixth to ninth auxiliary request were submitted at this point of the proceedings in order to overcome the clarity objections raised for the first time during the proceedings by the board of appeal in the summons to oral proceedings. Since all amendments were intended to overcome the clarity objections raised in the summons, the request to allow the claims of the sixth to ninth auxiliary requests into the proceedings so as to overcome the newly raised objections was justified.
Reasons for the Decision

1. The appeal is admissible.

2. Main request

2.1 Amendments

Claim 1 as amended is based on claims 1, 9 and 10 as originally filed and on the original description (cf page 7, second paragraph to page 8, fourth paragraph).

Accordingly, claim 1 as amended complies with Article 123(2) EPC.

2.2 Novelty

According to the decision under appeal, the subject-matter of claim 1 of the main request lacked novelty over document D5.

Document D5 discloses an organic thin film transistor comprising a substrate (12), a gate electrode (14), a dielectric layer (18), a source electrode (22), a drain electrode (24), a semiconductor layer (20) and a barrier layer (16), wherein the barrier layer comprises a polymer, an antioxidant and an inorganic particulate material (cf paragraph [0074]; figure 1).

In particular, the surface modifying film 18 has a thickness of 400 Angstrom or less and is made of a dielectric material, and thus qualifies as a dielectric layer within the meaning of claim 1 (cf D5, paragraphs [0079] to [0084]).
The appellant's argument that the layer 16 of D5 is not a barrier or encapsulation layer in the sense of the present invention, which is the outermost layer encapsulating the organic thin film transistor device, is not persuasive as claim 1 does not define layer 16 in these terms.

Regarding the composition of layer 16, it is noted that according to D5 the layer comprises a polymer (cf paragraphs [0045] to [0072]) which can include, for example, fillers and antioxidants (cf paragraphs [0071], [0072]). The fact that these additives are optional cannot not detract from the combination of polymer, filler and antioxidant being disclosed in D5.

Accordingly, the subject-matter of claim 1 lacks novelty in the sense of Article 54(1) EPC 1973 over D5.

2.3 Moreover, for the sake of completeness, and in particular in view of the auxiliary requests in which amendments are made to clarify that the barrier layer is an encapsulation layer, the following is noted:

Document D1 discloses a thin film transistor comprising a substrate (400), a gate electrode (405), a dielectric layer (401b), a source electrode (404), a drain electrode (404), a semiconductor layer (403) and a barrier/encapsulation layer (413), wherein the barrier/encapsulation layer comprises a polymer, an antioxidant (eg 2-hydroxy-4-octyloxybenzophenone) and an inorganic particulate material (eg fine particles of zeolite or a metal such as iron and modified titanium dioxide), where the particles are impregnated with the benzophenone (cf paragraphs [0055], [0061], [0062], [0090] and [0099]; figure 4A).
Accordingly, contrary to the appellant's argument, document D1 discloses a barrier/encapsulation layer with a polymer, an antioxidant and an inorganic particulate material in combination.

Not disclosed in D1 is that the thin film transistor is an organic transistor.

Accordingly, the subject-matter of claim 1 is new over document D1.

2.4 Inventive step

Document D1 is silent as to the nature of the thin film transistor. Accordingly, the objective problem to be solved starting from D1 is to provide a suitable material for the active layer of the thin film transistor.

As organic thin film transistors are well known, and in view of the fact that in D1 the transistor is part of an organic light-emitting device, it would be obvious to a person skilled in the art to provide an organic active layer in the thin film transistor of D1.

Accordingly, the subject-matter of claim 1 lacks an inventive step in the sense of Article 56 EPC 1973.

2.5 The appellant's main request is, therefore, not allowable.

3. First auxiliary request
3.1 Claim 1 according to the first auxiliary request is unclear as it defines the thin film transistor to comprise an encapsulation layer and then specifies details of a barrier layer not previously defined.

3.2 The appellant argued that according to established case law of the Technical Boards of Appeal of the EPO and Article 69 EPC, the claims should be interpreted in the light of the description and figures. Although Article 69 EPC related to the scope of protection of the claims, the same principle also applied to the clarity of the claims under Article 84 EPC.

As was evident from the description, for example page 2, lines 1 and 12, and further from page 7 third paragraph, the expressions "barrier layer" and "encapsulation layer" were used interchangeably throughout the application. This was also evident from the heading on page 13 referring to a "barrier or encapsulation layer". In the light of the description, it was therefore readily apparent that the terms "encapsulation layer" and "barrier layer" referred to in claim 1 related to the same feature. Furthermore, in case a skilled person would be unsure about the two terms in claim 1, he would refer to the description. From the general part of the disclosure, he would immediately take that the definition of the barrier layer related to the aforementioned encapsulation layer in claim 1. Accordingly, the subject-matter of the claims of the first auxiliary request was in accordance with the requirements of clarity under Article 84 EPC.

3.3 In the board's judgement, however, Article 69 EPC and the Protocol on its interpretation relate to the extent of protection conferred by the patent or patent application under consideration only in the context of
Article 123(3) EPC and in infringement proceedings, and have no bearing on the clarity of a claim within the context of Article 84 EPC 1973 at issue in the present case.

According to Article 84 EPC 1973, the claims shall define the matter for which protection is sought. They shall be clear and concise and be supported by the description. In particular, in order to be allowed for grant Article 84 EPC thus requires claim 1 to provide a clear definition of the matter.

An entirely different issue is dealt with by Article 69 EPC and the corresponding protocol.

According to Article 69 EPC, the extent of the protection conferred by a European patent or a European patent application shall be determined by the claims. Nevertheless, the description and drawings shall be used to interpret the claims.

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

Article 2 of the protocol further specifies that for the purpose of determining the extent of protection conferred by a European patent, due account shall be taken of any element which is equivalent to an element specified in the claims.

Thus, for the assessment of the extent of the protection conferred by a European patent, the protocol strikes a balance between two poles in national practice, a strict literal claim wording approach and one including equivalents.

It is noted from the above that the protocol foresees, for the assessment of the extent of the protection conferred by a patent, employing the description and drawings for the purpose of resolving an ambiguity found in the claims. This, however, does not mean that an ambiguity can be accepted in the claims at the grant stage. Clarity of the claims is a requirement to be fully met before a patent can be granted.

Accordingly, rather than any interpretative undertakings, clarifying amendments should be the answer to clarity problems arising in examination proceedings.

3.4 As noted above, in claim 1, the expression "said barrier layer" does not have an antecedent in the claim. Due to this verbal inconsistency, the claim plainly lacks clarity.
Accordingly, claim 1 according to the first auxiliary request is not clear, contrary to the requirement of Article 84 EPC 1973.

3.5 The first auxiliary request is, therefore, not allowable.

4. **Second auxiliary request**

4.1 **Amendments**

Claim 1 according to the second auxiliary request differs from claim 1 of the main request in that it further defines that

- the antioxidant is 2-hydroxy-4-octyloxybenzophenone, and
- the inorganic particulate material is surface-modified aluminum oxide (Al$_2$O$_3$).

The amendments are based on the description (cf page 3, point (9) and page 4, points (12) to (15)).

Accordingly, claim 1 as amended according to the second auxiliary request complies with Article 123(2) EPC.

4.2 **Inventive step**

Reference is made to the finding of lack of an inventive step over document D1 above for the subject-matter of claim 1 according to the main request.

Moreover, the provision of 2-hydroxy-4-octyloxybenzophenone in the barrier layer is already known from D1, as discussed above for the main request.
As regards the selection of surface modified aluminium oxide as the particulate material, it is noted that according to document D1 the sealing layer should in particular prevent moisture from reaching the organic layers of the device.

Accordingly, the objective, further partial problem to be solved relative to document D1 in this respect is to provide a suitable moisture absorbing material to be included in the barrier layer.

It is noted that the assessment based on partial problems is considered appropriate in the present case, as the distinguishing features of claim 1 over D1 as discussed above do not provide any synergistic effect.

Alumina is commonly used as a desiccant and, thus, is an obvious choice for the skilled person to protect the device from moisture (cf eg document D2, page 19, lines 14 to 30).

Moreover, it is known, in order to make fillers compatible with the polymer system, to treat their surface with eg a silane reagent (cf document D5, paragraph [0072]).

Accordingly, having regard to the state of the art, the subject-matter of claim 1 is obvious to a person skilled in the art.

The appellant argued that based on a combination of D1, D2 and D5, a skilled person would have to cherry-pick a specific benzophenone for one of the layers of D1, for which he had no motivation, based on D1. He would then have to combine said modified teaching with commonly known aluminum oxide as a suitable filler material for
said layer, and moreover have to combine the selected aluminum oxide with the feature of a surface modification using a silane reagent, as disclosed in D5, for which a skilled person clearly did not have any motivation, based on D1, D2 or his common knowledge.

It is, however, noted generally for selection inventions that only if the selection is connected to a particular technical effect, and if no hints exist leading the skilled person to the selection, an inventive step may be accepted.

In the present case, no particular technical effect is provided in the application. In fact, in the application the claimed materials are generally listed with other similar materials. None of the selected materials is highlighted with respect to the other materials as having any particular merit. It is noted in this respect that while the only example of the invention in the application includes the claimed specific materials (cf Example 1), comparison is only made with examples in which one or more of these materials are omitted (cf Comparative Examples 1 to 3). Accordingly, there is no support in the application for the claimed selection being connected to any particular technical effect.

Moreover, as discussed above, hints exist in the state of the art, in particular concerning the choice of alumina particles for absorbing moisture and the provision of a surface treatment, leading the skilled person to the selection.

Accordingly, the subject-matter of claim 1 according to the second auxiliary request lacks an inventive step in the sense of Article 56 EPC 1973.
The second auxiliary request is, therefore, not allowable either.

5. Third auxiliary request

Claim 1 according to the third auxiliary request is unclear for the same reasons given for the first auxiliary request, contrary to the requirement of Article 84 EPC 1973.

Accordingly, the third auxiliary request is also not allowable.

6. Fourth auxiliary request

6.1 Claims 1 to 3 according to the fourth auxiliary request are unclear as an order is specified, however, without defining in which respect the order is given (Article 84 EPC 1973). In case a stacking order would be intended, it is noted that for example the source and drain electrodes are not stacked.

The appellant argued that since the claims should be interpreted in the light of the description and figures, it was immediately evident to a skilled person, especially on the basis of the figures provided with the application, that the "order" of layers recited in claim 1 related to the stacking of the layers on top of each other. As the stacking of drain and source electrodes on top of each other did not make technical sense, such an arrangement would be ruled out by the skilled person.

However, as discussed above in the board's judgement there is no case for interpretative undertakings at
this procedural stage when claims are found to be unclear. The expression "in order" was introduced for the first time in this request. If it is found to be unclear, it should be amended.

Accordingly, claims 1, 2 and 3 according to the fourth auxiliary request are not clear, contrary to the requirement of Article 84 EPC 1973.

6.2 Moreover, for the sake of completeness it is noted that it is commonly known to form an organic thin film transistor with the gate electrode underlying the active layer and the source and drain electrodes overlying the active layer (see eg figure 1 of D5). Accordingly, it would be obvious to a person skilled in the art to apply the protective layer of D1 to such a transistor arrangement.

Accordingly, as far as clear, the subject-matter of claim 1 according to the fourth auxiliary request lacks an inventive step in the sense of Article 56 EPC 1973 over D1.

Claims 2 and 3 provide obvious alternative thin film transistor arrangement.

6.3 The fourth auxiliary request is, therefore, not allowable either.

7. *Fifth auxiliary request*

Claim 1 according to the fifth auxiliary request is unclear for the same reasons given for the fourth auxiliary request (Article 84 EPC 1973).
Moreover, as far as clear, the subject-matter of claim 1 lacks an inventive step in the sense of Article 56 EPC 1973 over D1 for the same reasons given above with respect to the fourth auxiliary request.

The fifth auxiliary request is, therefore, also not allowable.

8. Sixth to ninth auxiliary requests

8.1 The sixth to ninth auxiliary requests were filed after the oral proceedings were arranged.

According to Article 13(1) RPBA, any amendment to a party's case after it has filed its grounds of appeal or reply may be admitted and considered at the board's discretion. The discretion shall be exercised in view of inter alia the complexity of the new subject-matter submitted, the current state of the proceedings and the need for procedural economy.

According to established jurisprudence of the boards of appeal, late-filed request which prima facie do not overcome all outstanding objections are not admitted into the proceedings (cf "Case Law of the Boards of Appeal of the EPO", 7th edition, IV.E.4.4.2).

8.2 Sixth auxiliary request

In claim 1 according to the sixth auxiliary request, the verbal inconsistency in claim 1 according to the first auxiliary request has been resolved. On a prima facie assessment, however, it is clear that the subject-matter of claim 1 according to the sixth auxiliary request lacks an inventive step in the sense of Article 56 EPC 1973 over document D1 for the same
reasons given for the main request, as the layer (413) of D1 is an encapsulation layer.

Accordingly, the sixth auxiliary request clearly does not overcome the outstanding objection with respect to lack of an inventive step.

8.3 Seventh auxiliary request

Similarly, it is clear that, while the verbal inconsistency in the third auxiliary request has been resolved, the subject-matter of claim 1 according to the seventh auxiliary request lacks an inventive step in the sense of Article 56 EPC 1973 over document D1 for the same reasons given for the second auxiliary request.

Accordingly, also the seventh auxiliary request clearly does not overcome the outstanding objection with respect to lack of an inventive step.

8.4 Eighth and ninth auxiliary request

In both the eighth and ninth auxiliary request, independent claims 2 and 3 remain unchanged with respect to the fourth and fifth auxiliary request. These claims are still unclear for the same reasons given above for these requests.

The eighth and ninth auxiliary request, thus, clearly do not overcome the outstanding objection of lack of clarity under Article 84 EPC 1973.

8.5 Accordingly, none of the sixth to ninth auxiliary requests overcomes the outstanding objections.
The appellant argued that these requests were submitted at this point of the proceedings in order to overcome the clarity objections raised for the first time during the proceedings by the board of appeal in the summons to oral proceedings.

However, while the sixth and seventh auxiliary request overcome the clarity objections raised in the communication annexed to the summons to oral proceedings before the board, they do not overcome the outstanding objections as to lack of an inventive step, as noted above. The eighth and ninth auxiliary requests do not overcome the outstanding clarity objections. The board would, thus, have to maintain objections previously raised against each of these request, which clearly would be contrary to the need for procedural economy.

Accordingly, the board exercises its discretionary powers under Article 13(1) RPBA not to admit the sixth to ninth auxiliary request into the proceedings.
Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

S. Sánchez Chiquero G. Eliasson

Decision electronically authenticated