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Datasheet for the decision of 8 March 2016

Case Number: T 1708/12 - 3.3.03

Application Number: 04750548.2

Publication Number: 1615971

IPC: B82Y30/00

Language of the proceedings: EN

Title of invention:
WATER DISPERSIBLE POLYTHIOPHENES MADE WITH POLYMERIC ACID COLLOIDS

Patent Proprietor:
E. I. du Pont de Nemours and Company

Opponent:
Heraeus Precious Metals GmbH & Co. KG

Headword:

Relevant legal provisions:
EPC Art. 123(2), 56

Keyword:
Amendments - allowable (yes)
Inventive step - non-obvious solution

Decisions cited:

Catchword:

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European Patent Office
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Chambres de recours

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Case Number: T 1708/12 - 3.3.03

D E C I S I O N
of Technical Board of Appeal 3.3.03
of 8 March 2016

Appellant: (Patent Proprietor)	E. I. du Pont de Nemours and Company Chestnut Run Plaza 974 Center Road P.O. Box 2915 Wilmington, DE 19805 (US)
Representative:	Towler, Philip Dean Dehns St Bride's House 10 Salisbury Square London EC4Y 8JD (GB)
Appellant: (Opponent)	Heraeus Precious Metals GmbH & Co. KG Heraeusstrasse 12-14 63450 Hanau (DE)
Representative:	Herzog, Fiesser & Partner Patentanwälte PartG mbB Immermannstrasse 40 40210 Düsseldorf (DE)
Decision under appeal:	**Interlocutory decision of the Opposition Division of the European Patent Office posted on 18 May 2012 concerning maintenance of the European Patent No. 1615971 in amended form.**

Composition of the Board:

Chairman M. C. Gordon
Members: F. Rousseau
C. Brandt

Summary of Facts and Submissions

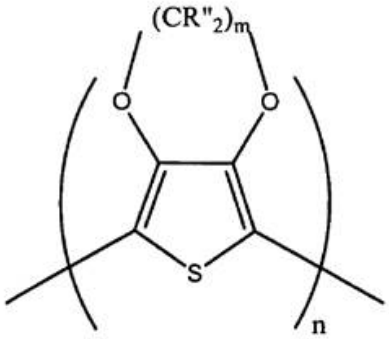
I. The appeals by the patent proprietor and the opponent lie against the interlocutory decision of the opposition division posted on 18 May 2012 according to which European patent No. 1 615 971 as amended according to the documents of the first auxiliary request submitted during the oral proceedings on 6 March 2012 met the requirements of the EPC.

II. The patent in suit was granted on European patent application number 04750548.2, derived from international application number PCT/US2004/012564, published as WO 2004/094501 had been opposed in its entirety on the grounds that its subject-matter lacked novelty and inventive step (Article 100(a) EPC), was insufficiently disclosed (Article 100(b) EPC) and extended beyond the content of the application as filed (Article 100(c) EPC). The following documents had been cited in the impugned decision:

E1: WO 2004/029128
E6: JP-A-2003-297582 and a translation thereof

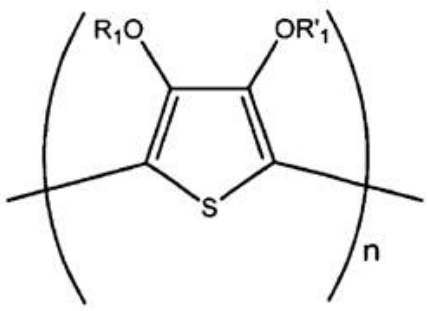
III. The statement setting out the grounds for appeal of the patent proprietor was submitted with letter of 28 September 2012 to which were attached a main request as well as first to fourth auxiliary requests. The second auxiliary request consisted of one claim reading as follows:

"1. A method of forming a composition comprising an aqueous dispersion of at least one polythiophene, at least one colloid-forming polymeric acid and a co-dispersing liquid, wherein said polythiophene comprises the Formula I(a) or Formula I(b):



(Ia)

wherein:
R" is the same or different at each occurrence and is selected from hydrogen, alkyl, heteroalkyl, alkenyl, heteroalkenyl, alcohol, amidosulfonate, benzyl, carboxylate, ether, ether carboxylate, ether sulfonate, sulfonate, and urethane, with the proviso that at least one R" is not hydrogen,
m is 2 or 3, and
n is at least about 4; or

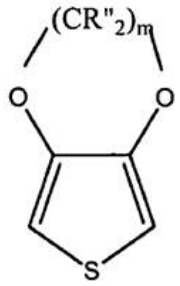


(Ib)

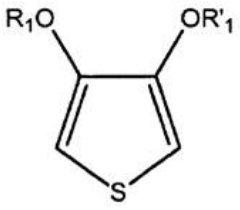
wherein:

R'_1 and R_1 are independently selected from hydrogen and alkyl, or
R'_1 and R_1 taken together form an alkylene chain having 1 to 4 carbon atoms, which may optionally be substituted by alkyl or aromatic groups having 1 to 12 carbon atoms, or a 1,2- cyclohexylene radical, and
n is at least about 4;

wherein said colloid-forming polymer acid comprises a fluorinated polymeric sulfonic acid; and
wherein the aqueous dispersion has a pH of 4 to 8; said method comprising:
polymerizing at least one thiophene monomer in the presence of the at least one colloid-forming polymeric acid, one oxidizing agent, and one polymerisation catalyst,
wherein said thiophene monomer has Formula II(a) or Formula II(b):



(IIa)



(IIb)

wherein:
R" is the same or different at each occurrence and is selected from hydrogen, alkyl, heteroalkyl, alkenyl, heteroalkenyl, alcohol, amidosulfonate, benzyl, carboxylate, ether, ether carboxylate, ether sulfonate, and urethane, with the proviso that at least one R" is not hydrogen,
m is 2 or 3;
R'_1 and R_1 are independently selected from hydrogen and alkyl, or
R'_1 and R_1 taken together form an alkylene chain having 1 to 4 carbon atoms, which may optionally be substituted alkyl or aromatic having 1 to 12 carbon atoms, or a 1,2 cyclohexylene radical; and adding the at least one co-dispersing liquid after the thiophene polymerisation."In addition, the patent proprietor submitted the following document:

E7 (A. Aleshin *et al.*: "Transport properties of poly(3,4-ethylenedioxythiophene)/ poly(styrenesulfonate), Synthetic Metals 94 (1998) 173-177).

IV. The statement setting out the grounds for appeal of the opponent was submitted with letter of 27 September 2012.

V. The rejoinder of the opponent was submitted with letter of 11 April 2013 to which was attached the following document:

E10: M.P.de Jong *et al.*: "Stability of the interface between indium-tin-oxide and poly(3,4-ethylenedioxythiophene/poly(styrenesulfonate) in polymer light-emitting diodes"; Applied Physics Letters, vol. 77(14)(2000), pages 2255-2257.

VI. The rejoinder of the patent proprietor was submitted with letter of 15 April 2013 to which were attached a main request and first to fourteenth auxiliary requests, the fourth auxiliary request being indicated to correspond to the second auxiliary request submitted with the statement of grounds of appeal.

VII. Further submissions of the opponent were made with letter of 18 March 2015.

VIII. A summons to oral proceedings were issued on 7 September 2015.

IX. The patent proprietor made additional submissions with letter of 5 November 2015.

X. A Board's communication, dated 22 February 2016 and sent in advance by telefax on 18 February 2016 was issued.

XI. In the course of the oral proceedings held on 8 March 2016, the patent proprietor submitted a new main request, which compared to the fourth auxiliary request submitted with letter of 15 April 2015 (second auxiliary request submitted with the statement of grounds of appeal), had been amended by replacing the wording "*a*" by the expression "*at least one*" in the first paragraph of the claim, said amended paragraph reading as follow:

"A method of forming a composition comprising an aqueous dispersion of at least one polythiophene, at least one colloid-forming polymeric acid and ~~a~~ at least one co-dispersing liquid, wherein"

XII. The submissions of the patent proprietor, as far as relevant for the decision, can be summarized as follows:

(a) No multiple selections were necessary to arrive at the combination of features defined by the present claim, said combination being directly and unambiguously disclosed in the application as filed in view of claim 19, page 21, lines 10-12, page 9, lines 28-34, page 14, lines 15-17, page 15, lines 37-38, page 16, first paragraph and examples 3 to 9 and 11. Accordingly, the subject-matter of the claim met the requirements of Article 123(2) EPC.

(b) As to inventive step, the closest prior art was represented by the method described in paragraph 134 of E6. The problem successfully solved over the

closest prior art was the provision of a method for preparing a composition suitable for the preparation of a buffer layer in organic light emitting devices which causes less corrosion, but allows an acceptable level of performance of those organic light emitting devices to be maintained. As none of the prior art documents on file suggested that the selection of a pH value in the range of 4 to 8 and the addition of a co-dispersing liquid after thiophene polymerisation could solve that problem, the claimed solution was inventive.

XIII. The submissions of the opponent, as far as relevant for the decision, can be summarized as follows:

(a) It was not disputed that the use of pH values within the range of 4 to 8 was disclosed in the application as filed. However, that range was not directly and unambiguously disclosed in the application as filed in combination with the step of adding a co-dispersing liquid after the thiophene polymerisation step. Hence, the claim did not meet the requirements of Article 123(2) EPC. Sufficiency of disclosure and novelty were not challenged.

(b) As regard inventive step, it was not disputed that the method described in paragraph 134 of E6 represented the closest prior art and that the problem successfully solved over that prior art was the one identified by the patent proprietor. Arguments in support of the position that the prior art suggested the claimed method in order to solve that problem, in particular the addition of a co-dispersing liquid after thiophene polymerisation, were not advanced.

XIV. The appellant I/patent proprietor requested that the decision under appeal be set aside and that the patent be maintained in amended form on the basis of the main request submitted at the oral proceedings on 8 March 2016.

XV. The appellant II/opponent requested that the decision under appeal be set aside and that the European patent be revoked.

XVI. At the end of the oral proceedings the decision of the Board was announced.

Reasons for the Decision

1. *Amendments*

1.1 In accordance with the established Case Law of the Boards of Appeal of the EPO, the relevant question to be decided in assessing whether the subject-matter of an amended claim extends beyond the content of the application as filed, is whether after the amendment the skilled person is presented with new technical information (see G 2/10 (OJ 2012, 376), point 4.5.1 of the Reasons and Case Law of the Boards of Appeal of the EPO, 7th edition 2013, II.E.1). In other words, the above mentioned amendments are only allowable if the skilled person would derive the resulting claimed subject-matter directly and unambiguously, using common general knowledge from the application as filed.

1.2 Amended claim 1 is based on a combination of the information contained in the application as filed disclosing the method for producing an aqueous

dispersion of at least one polythiophene by polymerising at least one thiophene monomer in the presence of at least one colloid-forming polymeric acid (claim 19), implicitly leading to the composition of original claim 1, said colloid-forming polymeric acid comprising a fluorinated polymeric sulfonic acid (claim 3), said method also comprising the addition of at least one co-dispersing liquid after the thiophene polymerisation (claim 26 dependent on claim 19 and page 16, lines 1-11), the aqueous dispersion having a pH value in the range of 4 to 8, as implicitly disclosed on page 21, lines 10-22.

1.3 The opponent does not dispute that those features are - individually - disclosed in the application as filed, but rather takes the position that the step of adding the co-dispersing liquid is not disclosed in combination with a pH value of the aqueous dispersion in the range of 4 to 8. In view of the advantages resulting from the addition of a co-dispersing liquid after the polymerisation step described on page 16, lines 3-11 and of a pH higher than 3-4, i.e. in the range of 4 to 8, as disclosed in the context of the passage on page 21, lines 10-12, those two features are directly and unambiguously disclosed as preferred embodiments of the application as filed. Moreover, the methods described in examples 3, 4, 5 and 7 of the application as filed are illustrative embodiments of amended claim 1, i.e. embodiments showing in combination a pH value of the dispersion within the range now defined and the addition of a co-dispersing liquid after polymerization. More importantly, examples 5 and 7 expressly refer to the advantages resulting from the addition of a co-dispersing liquid that are indicated in the passage mentioned above (page 16, lines 3-11) as the reason for said addition.

1.4 Accordingly, the definition in amended claim 1 of adding the co-dispersing liquid and using a pH value in the range of 4 to 8 does not result from acombination of two separate and distinct embodiments, but is supported by a direct and unambiguous teaching in the application as filed pointing toward a consistently expressed preference for these two features in combination in order to solve the technical problem underlying the application. Consequently, the objection that the subject-matter of amended claim 1 does not meet the requirements of Article 123(2) EPC fails to convince.

1.5 The subject-matter of amended claim 1 represents due, *inter alia* to the presence of the step of adding at least one-co-dispersing liquid after the thiophene polymerisation a restriction of the subject-matter of claim 10 as granted. Accordingly, the present request meets the requirements of Article 123(3) EPC.

2. Sufficiency of disclosure and novelty of the claimed subject-matter were not contested. The Board has no reason to come to another conclusion and is therefore satisfied that the requirements of Articles 83 and 54 EPC are met.

3. Inventive step

Closest prior art

3.1 The parties agree that the embodiment disclosed in paragraph 134 of E6 represents the closest prior art. E6 and the embodiment described in its paragraph 134, concerns like the patent in suit dispersions of polythiophene that can be used for the preparation of a

buffer layer in organic light emitting devices. It is noted in this context that the terms "buffer layer" as used in the patent in suit and "hole-injection layer" as used in E6 have the same meaning (see paragraph 4 of the patent in suit). The dispersion of polythiophene used in the embodiment described in paragraph 134 of E6 is a dispersion of poly(ethylene dioxythiophene) / polystyrene sulphonic acid (Baytron® P VP Al4083) to which is added a 5% solution of Nafion (i.e. a colloid-forming polymer acid comprising a fluorinated polymeric within the meaning of the patent in suit, see the exemplified embodiments of the patent in suit) in a mixture of a "lower alcohol" and water. The Board is therefore satisfied that E6 represents a suitable starting point for assessing inventive step.

3.2 It was not disputed that the claimed method differs from that described in paragraph 134 of E6 in that the colloid-forming polymer acid comprising a fluorinated polymeric is added before polymerisation so that polymerisation takes place in its presence and that the pH is adjusted in the range of 4 to 8. As to the pH, the Board agrees with the position taken by the patent proprietor, that the pH value of the dispersion described in paragraph 134 of E6 comprising both Baytron® P VP Al4083 and Nafion® cannot be considered to be within the range of 4 to 8 as presently claimed, in view of the highly acidic character of Baytron® P VP Al4083 and Nafion® evidenced by comparative example 2 of E1 and the necessity, identified in E10 page 2255 and discussed in the patent in suit (for example in paragraphs [0080], [0106] and [0107] to adjust the pH of the dispersion after having polymerised the thiophene monomer in the presence of Nafion®, respectively.

Problem solved

3.3 Having regard to the disclosure of E6, the patent proprietor formulated the technical problem solved by the subject-matter of claim 1 as being to provide a method for preparing a composition suitable for the preparation of a buffer layer in organic light emitting devices which causes less corrosion, but allows to maintain an acceptable level of performance of those organic light emitting devices. The opponent did not dispute that the claimed method, characterized inter alia by the polymerisation of the thiophene monomer in the presence of at least one colloid-forming polymeric acid comprising a fluorinated polymeric sulfonic acid, the addition of at least one co-dispersing liquid after the thiophene polymerisation and a pH of 4 to 8 for the aqueous dispersion, provided a successful solution to said problem. The Board has no reason to take a different position on this matter. The use of a less acidic environment is well known to the skilled person to be desirable in order to reduce corrosion, as acknowledged in the patent in aforementioned paragraph [0080] which statement is consistent with the aforementioned teaching of E10 (page 2255) in the context of polymer light-emitting diodes.However, increasing the pH could be expected to reduce the electrical conductivity of the poly(ethylene dioxythiophene), as suggested by results reported in section 3 of E7 for poly(ethylene dioxythiophene) / polystyrene sulphonic acid dispersions. However, the addition a co-dispersing liquid after the polymerisation step has been demonstrated in the patent in suit to bring about an increase of conductivity, as shown by the data of examples 5 and 7 for the addition of ethylene glycol and methanol, respectively. It is therefore credible that the addition of a co-dispersing

liquid after the polymerisation step allows to mitigate the negative effect on electrical conductivity of higher pH values that are required to avoid corrosion.

Obviousness

3.4 It remains to be decided whether or not the proposed solution to the problem underlying the patent in suit is obvious in view of the state of the art. The closest prior art E6 teaches that the conductive polymer is prepared by polymerisation in the presence of a super-strong acid (see paragraph 29), which super-strong acid can be Nafion® (paragraph 16). However, on the basis of the disclosure forming the closest prior art i.e. the method disclosed in paragraph 134 of E6, the skilled person seeking a method to polymerise ethylene dioxythiophene in the presence of the super-strong acid used in paragraph 134 of E6 would not derive any indication to add the same co-dispersing liquid after polymerisation, as said co-dispersing liquid had been added together with Nafion® as part of the solution containing said super-strong acid. Hence, should the skilled person seeking to provide a method of forming an aqueous dispersion of poly(ethylene dioxythiophene) in the presence of the same source of super-strong acid or in the presence of a different source of strong acid or of another strong acid, it would be necessary, in order to arrive at the claimed method, to find a teaching to add a co-dispersing liquid after polymerisation rather than prior to polymerisation. The opponent however, did not cite any prior art suggesting for any reason the addition of a co-dispersing liquid after polymerisation of ethylene dioxythiophene. In particular there was no indication to be taken from the prior art that so doing would result in increased electrical conductivity of poly(ethylene

dioxythiophene), let alone would serve to mitigate the negative effect on conductivity arising as a consequence of the higher pH values required to avoid corrosion. Accordingly, it has not been shown that the skilled person would, in view of the prior teaching available have arrived at the subject-matter of present claim 1 in an obvious manner.

3.5 Consequently, the subject-matter of present claim 1 meets the requirements of Article 56 EPC.

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 sole claim 1 of the main request as filed during the oral proceedings on 8 March 2016 and after any necessary consequential amendment of the description.

3. The appeal filed by appellant II is dismissed.

The Registrar: The Chairman:

B. ter Heijden M. C. Gordon

Decision electronically authenticated