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**Datasheet for the decision
of 11 May 2010**

Case Number: T 1918/07 - 3.4.02

Application Number: 00910092.6

Publication Number: 1163544

IPC: G02B 5/20

Language of the proceedings: EN

Title of invention:

Ultraviolet filters with enhanced weatherability and method of making

Applicant:

SABIC Innovative Plastics IP B.V.

Headword:

-

Relevant legal provisions:

EPC Art. 56, 84
EPC R. 42(1)(e)

Keyword:

"Clarity (yes)"
"Inventive step (yes - proper selection of the closest prior art)"

Decisions cited:

T 0990/07

Catchword:

-



Case Number: T 1918/07 - 3.4.02

D E C I S I O N
of the Technical Board of Appeal 3.4.02
of 11 May 2010

Appellant: SABIC Innovative Plastics IP B.V.
Plasticslaan 1
NL-4612 PX Bergen op Zoom (NL)

Representative: Modiano, Micaela Nadia
Modiano Josif Pisanty & Staub Ltd
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Decision under appeal: Decision of the Examining Division of the
European Patent Office posted 19 June 2007
refusing European application No. 00910092.6
pursuant to Article 97(1) EPC 1973.

Composition of the Board:

Chairman: A. G. Klein
Members: F. J. Narganes-Quijano
D. S. Rogers

Summary of Facts and Submissions

I. The appellant (applicant) lodged an appeal against the decision of the examining division refusing European patent application No. 00910092.6 based on the International application No. PCT/US00/03076 (published with the International Publication No. WO 00/55654).

In the decision under appeal the examining division held that - as previously communicated to the appellant in a telephone consultation - the set of amended claims filed by the appellant about ten days after expiry of the final date set out under Rule 71a EPC 1973 in the summons to oral proceedings did not *prima facie* comply with the requirements of Articles 123(2), 84 and 56 EPC 1973. In view of this finding and of the absence of the appellant at the oral proceedings, the examining division did not admit the set of amended claims into the proceedings pursuant to Article 114(2) and Rule 71a EPC 1973. In its decision the examining division also expressed its view that the subject-matter of claim 1 of the set of claims previously on file did not involve an inventive step (Article 56 EPC 1973).

In its decision the examining division referred to the following documents:

- D3: JP-A-9049922 and the corresponding abstract published in "Patent Abstracts of Japan"
- D6: "Tin- and indium-doped zinc oxide films prepared by RF magnetron sputtering" C. X. Qiu *et al.*, Solar Energy Materials Vol. 13, 1986; pages 75 to 84
- D7: EP-A-0807846

D10: US-A-5864419
D11: DE-A-19631728
D13: JP-A-8249929 and the corresponding abstract
published in "Patent Abstracts of Japan"
D14: US-A-5763063
D15: WO-A-9011975
D16: US-A-5008148.

- II. With the statement setting out the grounds of appeal the appellant submitted several sets of claims amended according to different requests and requested that the decision under appeal be set aside and a patent be granted.
- III. With a letter dated 25 February 2010 the appellant filed two new sets of claims amended according to a main and an auxiliary request. With the same letter the appellant filed amended pages 1 to 9 and 11 to 33 of the description with the text on page 33 being wholly crossed out, and with a subsequent letter dated 14 April 2020 the appellant filed an amended page 10 of the description and an amended drawing sheet 2/9 replacing the corresponding application documents on file.
- IV. Claims 1 and 4 amended according to the present main request of the appellant read as follows:
- "1. A method of preparing a layered structure comprising the steps of:
providing a transparent polymeric substrate (1) selected from the group consisting of polycarbonate polyestercarbonate, polyethersulfone and polyetherimide; and

forming an indium doped zinc oxide layer (2) directly on the polymeric substrate (1) wherein the doped zinc oxide layer (2) has the formula $\text{In}_{0.02-0.15} \text{Zn}_{0.85-0.98} \text{O}$."

"4. The method of claim 1, wherein the optical density of the doped zinc oxide layer (2) is greater than 2.0 at a wavelength of 350 nm."

The main request further includes dependent claims 2, 3 and 5 to 14 all referring back to claim 1. The wording of these claims and of the claims of the auxiliary request is not relevant for the present decision.

V. The arguments of the appellant in support of its requests are essentially the following:

As regards document D6, the indium doped zinc oxide of the invention is not specifically mentioned in the document and, in addition, the high temperatures taught in the document (estimated to be about 100°C) would have led the person skilled in the art away from the use of polymeric substrates and precluded an expectation of success. The document discusses properties such as the resistivity of indium doped films and optical transmission measurements, but there is no teaching or suggestion of the water soak stability and the UV absorption of the films.

Document D16 discloses a process for coating moulded plastic articles made of polycarbonate or polyarylene sulphide with metal oxides such as zinc oxide; as discussed in the application, such coatings have poor water stability.

Document D3 discloses manufacturing conditions involving temperatures of about 600°C and thus relates to a process which would not be suitable for a polymeric substrate. In document D11 there is no teaching regarding weatherability or chemical resistance, document D10 describes sheets of conventional soda lime window glass and not a polymeric substrate, and documents D7, D13, D14 and D15 are concerned with different problems than that of the invention.

The affidavit signed by C. Iacovangelo shows experimental weatherability data for various zinc oxides and indium-doped zinc oxides coated on a polycarbonate substrate.

Reasons for the Decision

1. The appeal is admissible.
2. *Main request - Amendments*

The Board is satisfied that the application documents amended according to the present main request satisfy the formal requirements of the EPC, and in particular those set forth in Article 123(2) EPC. More particularly, claim 1 is based on claims 1, 2, 17, 18 and 28 and on the passages on page 1, first paragraph, page 5, third paragraph, page 6, last paragraph, page 7, line 7, page 10, line 25, and page 14, lines 9 and 10 of the application as published, and dependent claims 2 to 14 are based on claims 21, 22, 24 to 27,

29, 30, 41 to 44, 57 and 59 and the passage on page 7, lines 22 to 24 of the application as published.

The description has been revised and brought into conformity with the invention defined in the amended claims and the pertinent prior art has been appropriately acknowledged in the introductory part of the description (Article 84, second sentence and Rule 42(1), paragraphs (b) and (c) EPC).

3. *Main request - Clarity*

3.1 During the proceedings the application has been amended so that the claimed invention is directed to the formation of a layer of indium-doped zinc oxide on a polymeric substrate made of one of the specific polymeric materials specified in claim 1. As a result of the limitations imposed by these amendments, all the specific examples 1 to 23 disclosed on pages 21 to 32 of the description and relating all to the formation of a coating on a substrate made of glass do not represent examples of the claimed invention.

The fact that none of the specific examples 1 to 23 given in the description constitutes an example of the claimed subject-matter was objected by the examining division pursuant to Article 84 EPC 1973. However, in the view of the Board the fact that all these examples - which have been maintained in the description as presently amended for illustrative purposes only - do not constitute examples of the claimed invention does not constitute an objectionable deficiency, let alone a deficiency giving rise in the circumstances of the present case to an objection under the EPC. In

particular, the description specifies several alternative coating techniques that can be used in the formation of a coating of indium-doped zinc oxide on a transparent polymeric substrate as claimed (page 8, second paragraph, and page 11, third paragraph) and also contains a detailed description of several apparatuses that can be used in the formation of the claimed indium-doped zinc oxide coating together with the operation of the same (Figures 4 to 12 and the corresponding description on page 11, last paragraph to page 20, second paragraph). In addition, the specific examples 1 to 23 on pages 21 to 32 of the description - although all involving only substrates of glass - illustrate indirectly how the coating techniques and apparatuses referred to above can be applied to substrates made of the claimed polymeric materials. It follows that the claimed invention is fully supported by the description within the meaning of Article 84 EPC, second sentence, and is also sufficiently disclosed within the meaning of Article 83 EPC.

In addition, although none of the specific examples labelled 1 to 23 on pages 21 to 32 of the description constitutes an example of the claimed invention, the requirements of Rule 42(1) (e) EPC are complied with since this rule requires that the description "shall [...] describe in detail at least one way of carrying out the invention claimed using examples where appropriate" and, as already noted above, the description contains a detailed description of several ways of carrying out the invention. As regards the "examples" referred to in Rule 42(1) (e) EPC, the Board considers that in the circumstances of the present case in which the amended application documents satisfy the

requirements of Articles 83 and 84 EPC and the description describes in detail at least one way of carrying out the invention within the meaning of Rule 42(1) (e) EPC, specific examples are not indispensable and therefore the fact that none of the specific examples given in the description constitutes an example of the claimed invention does not give rise to any objection under Rule 42(1) (e) EPC which only requires specific examples of the invention "where appropriate" (see in this respect decision T 990/07, point 3 of the reasons, regarding Rule 27(1) (e) EPC 1973, the text of which is identical to Rule 42(1) (e) EPC).

- 3.2 In its decision the examining division also held that the feature of claim 1 then on file according to which "the optical density of the doped zinc oxide layer is greater than 2.0 at a wavelength of 350 nm" was not clear (Article 84 EPC 1973) on the grounds that no features were defined in the claim with which to achieve the desired optical density attributed to the coating layer.

In the application documents amended according to the present main request the objected feature has been shifted to dependent claim 4 (see point IV above) and, by virtue of its dependence on claim 1, the claim already defines features (in particular the composition) in terms of which the value of the optical density of the coating layer defined in dependent claim 4 can be achieved. In addition, the optical density is a common parameter in the field of coated transparent articles, and the application specifies how the parameter is determined (page 20, last paragraph)

and describes several examples illustrating how indium-doped zinc oxide coatings having a value of the optical density within the claimed range of values can be obtained (see page 21, last paragraph, page 22, third paragraph, and page 25, first paragraph to page 32, second paragraph).

In view of these considerations, the Board is satisfied that the feature defined in dependent claim 4 is sufficiently clear within the meaning of Article 84 EPC.

4. *Main request - Novelty and inventive step*

4.1 In agreement with the view expressed by the examining division during the examination proceedings, none of the documents on file discloses the formation of a layer of $\text{In}_{0.02-0.15} \text{Zn}_{0.85-0.98} \text{O}$ directly on a transparent substrate made of one of the polymeric materials specified in claim 1. The subject-matter of claim 1 of the main request is therefore novel over the available prior art (Article 54(1) EPC).

4.2 As regards the issue of inventive step, the examining division considered that the closest state of the art is represented by document D6 disclosing the formation of an indium-doped zinc oxide coating on a substrate of glass and held that, in view of the disclosure of documents D3, D7, D10, D11, D14, D15 and D16, it would be obvious to replace the glass substrate disclosed in document D6 by a substrate of a material selected among the polymeric materials specified in claim 1.

4.2.1 The Board, however, cannot follow the line of argument of the examining division for the following reasons.

Firstly, while according to the claimed subject-matter and the description (see page 1, first paragraph to page 2, second paragraph) the claimed invention is primarily directed to the UV absorbency and weatherability of coated transparent polymeric substrates, document D6 pertains to the field of semiconductors for photovoltaic applications and focus on the resistivity of doped zinc oxide films deposited on a glass substrate (abstract and section 2). Thus, the claimed subject-matter and the disclosure of document D6 have neither the main structural element (a polymeric substrate vs. a glass substrate) nor the primary technical purpose (weatherability vs. resistivity) in common, and only a technically unrealistic approach based on hindsight knowledge of the claimed invention (and in particular of the formation of an indium-doped zinc oxide layer having the claimed specific composition) would suggest selecting among all the documents on file document D6 as representing the closest state of the art.

And, secondly, only hindsight knowledge of the claimed invention would further suggest considering the replacement of the glass substrate of the coated glass substrate disclosed in document D6 and specifically designed for photovoltaic applications by a polymeric substrate made of one of the polymeric materials specified in claim 1, it being also noted that document D6 discloses manufacturing temperatures that are relatively high (of the order of 100°C, see page 76, third paragraph) and therefore generally impractical

with the use of polymeric substrates and that, in addition, - as it would be apparent in point 4.2.4 below - none of the documents D3, D7, D10, D11, D14, D15 and D16 referred to by the examining division in this respect addresses the issue of coated substrates for photovoltaic applications or suggests the replacement of a glass substrate by a polymeric substrate in the technical context of document D6.

4.2.2 As follows from the established case law developed by the Boards on the issue of the identification of the closest state of the art (see for instance "Case Law of the Boards of Appeal" 5th ed., EPO, 2006, chapter I, sections D.3.1 to D.3.5), a realistic and objective assessment of inventive step on the basis of the problem-solution approach requires starting with a prior art disclosure conceived for the same purpose or aiming at the same or similar objective as the claimed invention and having the most relevant technical features in common, and it is clear from the considerations in point 4.2.1 above that document D6 does not satisfy these conditions, especially not in the circumstances of the present case in which other documents on file are both structurally and functionally much closer to the claimed invention as document D6.

In particular, document D16 pertains to the same general technical field as the present application, i.e. to the field of coated polymeric substrates (D16, title and abstract), discloses the formation of a layer of zinc oxide directly on a transparent substrate of polycarbonate as it is the case in the claimed invention (D16, column 1, lines 6 to 12 together with

column 2, lines 38 to 40), and addresses the same technical problem primarily considered in the present application, i.e. overcoming the problems associated with the degradation of polymeric substrates exposed to UV radiation and to adverse weather conditions by providing the appropriate coating on the polymeric substrate (document D16, column 1, lines 16 to 23, and application, page 1, second paragraph to page 3, first paragraph). In addition, - as it would be apparent in point 4.2.4 below - no other document on file is closer to the claimed invention than document D16. Therefore, document D16 represents, among all the documents on file, the closest state of the art in the assessment of inventive step of the claimed invention.

- 4.2.3 The subject-matter of claim 1 differs from the disclosure of document D16 relating to the formation of a layer of zinc oxide directly on a transparent substrate of polycarbonate in that the material of the layer is doped with indium so as to have the composition $\text{In}_{0.02-0.15} \text{Zn}_{0.85-0.98} \text{O}$.

According to the disclosure of the application and the submissions of the appellant, the deposition of a zinc oxide coating on the polymeric substrate provides protection against degradation due to UV radiation (page 2, lines 1 to 5), but zinc oxide coatings dissolve in water and therefore the coated polymeric substrate has poor weatherability (page 2, lines 5 to 9), and this problem is solved by doping the zinc oxide with indium in the claimed range (page 2, second to fifth paragraphs, page 7, second paragraph to page 8, first paragraph, and the examples). The improvement of the weathering resistance of a zinc oxide coating by

doping the oxide with indium within the claimed range is further supported by the results of experiments carried out by the inventor named in the application in suit and shown in an affidavit submitted together with the statement of grounds of appeal.

Therefore, the distinguishing feature identified above in combination with the remaining claimed features improves the resistance to weathering of the coated polymeric substrate and the objective technical problem solved by the claimed invention over the disclosure of document D16 can be seen in improving the weathering resistance of the coated polymeric substrate, without however jeopardizing the other properties.

4.2.4 None of the documents on file discloses or suggests doping with indium a layer of zinc oxide coated on a polymeric substrate as claimed in order to solve the technical problem formulated above. In particular:

- Document D3 teaches the provision of a UV-shielding coating of indium-doped zinc oxide on a transparent substrate. However, the document refers to the use of the coating in lamps and illuminators (title of the document), i.e. in substrates that are generally of glass and, in addition, refers to manufacturing conditions requiring temperatures of 600°C (abstract, last line), thus excluding the use of polymeric substrates. In addition, the document is silent as to the weatherability of the film. Thus, the document is silent as to the objective problem formulated above and, in addition, teaches away from the formation of the coatings in substrates made of polymeric materials.

- Document D6 reports on the resistivity and the semiconducting and optical properties of indium-doped films deposited on a substrate. However, the substrates are made of glass (abstract and section 4) and, in addition, the document is silent as to the weatherability of the films and also silent as to any potential use of the coatings on a polymeric substrate.
- Documents D7 and D11 (see the respective abstract) pertain to the field of colour image displays, and while document D7 discloses films of aluminium-doped zinc oxide formed on substrates of glass or polyester (column 13, lines 13 to 20, and column 14, lines 10 to 17), document D11 discloses substrates of polycarbonate coated with indium tin oxide (page 12, lines 41 to 46). Document D13 discloses transparent electrode films of zinc and indium oxide formed on a transparent supporting substrate made of acrylic resin (abstract). Document D14 teaches improving the durability and the corrosion resistance of a metal coating by overcoating the metal coating with a double coating containing, among others, mixed indium and zinc oxide optionally doped with another metal (abstract, column 3, lines 37 to 42 and claim 29). Document D15 teaches improving the environmental stability of a metal layer by forming a dielectric layer of, among other oxides, indium or zinc oxide doped with a metal (abstract, page 3, lines 20 to 24, and page 6, line 4 *et seq.*). Finally, document D10 pertains to the field of electrochromic glazings and discloses the formation of electrically conductive coatings of indium tin oxide or doped zinc oxide on glass elements of the

glazings (column 30, lines 14 to 27) and the provision in the glazings of thin metal films of, among other possibilities, zinc or indium oxide (paragraph bridging columns 30 and 31). Thus, none of documents D7, D10, D11, D13, D14 and D15 addresses the objective problem formulated above, let alone suggests the formation of an indium-doped zinc oxide coating on a polymeric substrate as claimed.

The remaining documents on file are less relevant.

- 4.2.5 In view of the above considerations, the present Board cannot follow the examining division's view that the claimed subject-matter does not involve an inventive step within the meaning of Article 56 EPC with regard to the prior art on file.
- 4.3 The Board concludes that the subject-matter of claim 1 of the present main request is new and involves an inventive step with regard to the available prior art. The same conclusion applies to dependent claims 2 to 14 by virtue of their dependence on claim 1.
5. The Board is also satisfied that the application documents amended according to the main request and the invention to which they relate meet the remaining requirements of the EPC within the meaning of Article 97(1) EPC. The Board therefore concludes that the decision under appeal is to be set aside and a patent be granted on the basis of the amended application documents of the present main request of the appellant.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the department of first instance with the order to grant a patent in the following version:
 - claims: claims 1 to 14 of the main request filed with the letter dated 25 February 2010,
 - description: pages 1 to 9 and 11 to 32 filed with the letter dated 25 February 2010, and page 10 filed with the letter dated 14 April 2010, and
 - drawings: sheets 1/9 and 3/9 to 9/9 of the application as published and sheet 2/9 filed with the letter dated 14 April 2010.

The Registrar:

The Chairman:

M. Kiehl

A. G. Klein