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Case Number: T 0173/15 - 3.3.09

Application Number: 03258166.2

Publication Number: 1529632

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Language of the proceedings: EN

Title of invention:
Multilayered articles and method of manufacture thereof

Patent Proprietor:
SABIC Innovative Plastics IP B.V.

Opponents:
Covestro Deutschland AG/ Bayer Intellectual Property GmbH

Headword:

Relevant legal provisions:
EPC Art. 56

Keyword:
Inventive step (no, all requests)

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Catchword:

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Case Number: T 0173/15 - 3.3.09

D E C I S I O N
of Technical Board of Appeal 3.3.09
of 29 January 2018

Appellant: (Patent Proprietor)	SABIC Innovative Plastics IP B.V. Plasticslaan 1 4612 PX Bergen op Zoom (NL)
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Respondents: (Opponents)	Covestro Deutschland AG/ Bayer Intellectual Property GmbH Kaiser-Wilhelm Allee 60 / Alfred-Nobel-Strasse 10 51373 Leverkusen/40789 Monheim (DE)
Representative:	Cohausz & Florack Patent- & Rechtsanwälte Partnerschaftsgesellschaft mbB Bleichstraße 14 40211 Düsseldorf (DE)
Decision under appeal:	**Decision of the Opposition Division of the European Patent Office posted on 20 November 2014 revoking European patent No. 1529632 pursuant to Articles 101(2) and 101(3)(b) EPC**

Composition of the Board:

Chairman W. Sieber
Members: J. Jardón Álvarez
D. Prietzel-Funk

Summary of Facts and Submissions

I. This decision concerns the appeal filed by the patent proprietor (in the following: the appellant) on 13 January 2015 against the decision of the opposition division to revoke European patent No. 1 529 632.

II. The granted patent contained eight claims, claim 1 reading as follows:

"1. A multilayered sheet comprising:

a core layer comprising a thermoplastic polymer and an IR absorbing additive, wherein the IR absorbing additive is a boride;
a first cap layer comprising a thermoplastic polymer and an ultraviolet radiation absorbing additive; wherein a surface of the first cap layer is disposed upon and in intimate contact with a surface of the core layer; and
a second cap layer comprising a thermoplastic polymer and an ultraviolet radiation absorbing additive; wherein the second cap layer is disposed upon and in intimate contact with a surface of the core layer opposite the surface in contact with the first cap layer."

Independent claim 5 was directed to a method for manufacturing a multilayered sheet, and claims 2 to 4 and 6 to 8 were dependent claims.

III. The joint opponents (in the following: the respondents) had requested revocation of the patent in its entirety on the grounds of Article 100(a) EPC (lack of inventive step). The documents cited during the opposition proceedings included:

D7: S. Schelm *et al.*, "Dilute LaB_6 nanoparticles in polymer as optimized clear solar control glazing", Appl. Phys. Lett., Vol. 82, No. 24, 16 June 2003, pages 4346 to 4348; and

D9: WO 02/083412 A1.

IV. The opposition division's decision was based on a main request (granted claims) and 15 auxiliary requests. It may be summarised as follows:

- The subject-matter of claim 1 of the main request lacked inventive step over the disclosure of D9 in combination with the technical teachings of D7.

- D9 represented the closest prior-art document, in particular the embodiment on page 5, lines 1 to 4, which was directed to a coextruded sheet consisting of a thermoplastic layer (A) containing organic infrared absorber and UV absorber with a thin UV absorber layer on each side (layers (B)). The technical problem underlying the patent was to provide an alternative to this embodiment.

- The skilled person would have replaced the organic IR absorber used in D9 with the inorganic IR absorber disclosed in D7 and would thus have arrived at the subject-matter of claim 1 of the main request in an obvious manner.

- The same or a similar reasoning applied to the subject-matter of all auxiliary requests, which also lacked inventive step in view of the combined teachings of D9 and D7.

V. The statement setting out the grounds of appeal was filed on 27 March 2015. The appellant requested that the decision under appeal be set aside and that the patent be maintained as granted (main request). Alternatively, it requested that the patent be maintained in amended form with the claims according to auxiliary requests 1, 1a, 1b, 2 to 6, 7, 7a, 7b and 8 to 12 as filed with the statement of grounds of appeal.

VI. With their reply dated 28 September 2015 the respondents requested that the appeal be dismissed.

VII. In a communication the board indicated the points to be discussed during the oral proceedings.

VIII. Replies to the board's communication were filed by the appellant on 24 October 2017 and on 5 December 2017.

IX. On 29 January 2018 oral proceedings were held before the board. After the board had decided that the subject-matter of the claims of the main request and of auxiliary requests 1, 1a, 1b and 2 to 6 did not involve an inventive step, the appellant withdrew auxiliary requests 7, 7a, 7b and 8 to 12.

The claims of the main request are the granted claims (see point II above).

Claim 1 of auxiliary request 1 is based on claim 1 of the main request with the following additional feature:

- "wherein the thermoplastic polymer for use in the core and cap layers are polycarbonates."

Claim 1 of auxiliary request 1a is based on claim 1 of the main request with the following additional features:

- "wherein the thermoplastic polymer for use in the core and cap layers are polycarbonates and wherein the IR absorbing additive is lanthanum boride (LaB_6), praseodymium boride (PrB_6), neodymium boride (NdB_6), cerium boride (CeB_6), gadolinium boride (GdB_6), terbium boride (TbB_6), dysprosium boride (DyB_6), holmium boride (HoB_6), yttrium boride (YB_6), samarium boride (SmB_6), europium boride (EuB_6), erbium boride (ErB_6), thulium boride (TmB_6), ytterbium boride (YbB_6), lutetium boride (LuB_6), strontium boride (SrB_6), calcium boride (CaB_6), titanium boride (TiB_2), zirconium boride (ZrB_2), hafnium boride (HfB_2), vanadium boride (VB_2), tantalum boride (TaB_2), chromium borides (CrB and CrB_2), molybdenum borides (MoB_2, Mo_2B_5 and MoB), tungsten boride (W_2B_5), or a combination comprising at least one of the foregoing borides and further wherein the IR absorbing additive comprises nanosized particles having average particle dimensions of less than or equal to about 200 nanometers and is present in amounts of about 0.02 ppm to about 3000 ppm based on the total weight of the core layer."

Claim 1 of auxiliary request 1b corresponds to claim 1 of auxiliary request 1a, except that the IR absorbing additive is restricted to lanthanum boride (LaB_6).

Claim 1 of auxiliary request 2 is based on claim 1 of the main request with the following additional features:

- "wherein the thermoplastic polymer for use in the core and cap layers are polycarbonates and wherein the core layer has a thickness of 1 to 30mm."

Claim 1 of auxiliary request 3 is based on claim 1 of the main request with the following additional features:

- "wherein the thermoplastic polymer for use in the core and cap layers are polycarbonates and wherein the core layer has a thickness of 1 to 30mm and the cap layers have an average thickness of 10 to 120 micrometers."

Claim 1 of auxiliary request 4 is based on claim 1 of the main request with the following additional features:

- "wherein the thermoplastic polymer for use in the core and cap layers are polycarbonates and wherein the core layer has a thickness of 1 to 30mm and the cap layers have a thickness of 15 to 100 micrometers."

Claim 1 of auxiliary request 5 is based on claim 1 of the main request with the following additional features:

- "wherein the thermoplastic polymer for use in the core and cap layers are polycarbonates, wherein the core layer further comprises thermal stabilizers and has a thickness of 1 to 30mm and the cap layers have a thickness of 15 to 100 micrometers."

Claim 1 of auxiliary request 6 is based on claim 1 of the main request with the following additional features:

- "wherein the thermoplastic polymer for use in the core and cap layers are polycarbonates, wherein the core layer further comprises thermal stabilizers wherein the thermal stabilizers are phosphites, phosphonites, phosphines, hindered amines, hydroxyl amines, phenols, acryloyl modified phenols, hydroperoxide decomposers, benzofuranone derivatives, or a combination comprising at least one of the foregoing thermal stabilizers and wherein the core layer has a thickness of 1 to 30mm and the cap layers have a thickness of 15 to 100 micrometers."

X. The arguments of the appellant which are relevant for the present decision may be summarised as follows:

- D9 could be regarded as an appropriate starting point for the assessment of inventive step. The technical problem to be solved by the patent was the provision of a further passive design solution which would lead to reduced solar heat loads in automobiles as well as for residential and office buildings.

- The skilled person starting from D9 did not have any incentive to modify the multilayered structure therein disclosed by replacing the organic infrared absorber therein used. In fact, it would not have considered the disclosure of D7, since it related to conventional glass-based windows, a quite different technology. Moreover, the polymer used in D7, namely polyvinyl butyral, was quite different

from the polymers used in D9. Thus, the skilled person would have been further discouraged from combining the teaching of D7 with D9.

- The features added to the claims of the auxiliary requests further distinguished the claimed subject-matter from the disclosure of D9 and/or D7. In particular, there was no disclosure in D7 teaching the skilled person that LaB_6 particles could also be dispersed as individual particles in polycarbonates as claimed in all auxiliary requests.

XI. The relevant arguments of the respondents may be summarised as follows:

- Starting from D9 as the closest prior-art document, the combination of D7 with D9 rendered the claimed subject-matter obvious. In particular, D9 used organic IR absorbers in heat-absorbent multilayered structures, since inorganic IR absorbers had some drawbacks. However, these disadvantages were overcome by the teaching of D7, which hinted at the use of LaB_6 nanoparticles in polymers for solar control glazing.

- The features added to the claims of the auxiliary request were also non-inventive. They were already known to the skilled person from either D9 or D7, and no unexpected effect was associated with them.

XII. The appellant requested that the decision under appeal be set aside and that the patent be maintained on the basis of the claims as granted, or alternatively on the basis of the claims according to auxiliary requests 1,

1a, 1b or 2 to 6, all auxiliary requests as filed with the statement setting out the grounds of appeal.

The respondents requested that the appeal be dismissed.

Reasons for the Decision

1. The only issue at stake in the present appeal proceedings is that of inventive step.

MAIN REQUEST

2. The invention is directed to a multilayered sheet comprising a core layer disposed between two cap layers, all layers comprising a thermoplastic polymer. Furthermore, the core layer comprises a boride as an IR absorbing additive, and both cap layers comprise a UV absorbing additive (see claim 1).

The invention aims to provide passive design solutions leading to reduced solar heat loads in automobiles as well as for residential and office buildings (see paragraph [0003]). This is achieved by the claimed sheets, which absorb as much electromagnetic radiation as possible in the UV and IR regions of the electromagnetic spectrum, while at the same time being transparent to light in the visible region (see [0071]). They can therefore be used where heat produced by exposure to IR radiation is undesirable.

3. Closest prior art

3.1 Document D9 was regarded by the opposition division as the closest prior-art document. Both parties agreed

with that finding, and the board too finds this document to be an appropriate starting document for assessing inventive step.

3.2 D9, like the patent in suit, is directed to heat-absorbing multilayered structures (see abstract). It aims to provide multilayered structures that display outstanding long-term weathering resistance and excellent optical properties, such as transparency and gloss, and can be used for thermal insulation of transparent plastic glazing elements (see paragraph bridging pages 3 and 4).

3.3 In its broadest embodiment according to claim 1, D9 discloses a transparent heat-absorbent multilayered structure comprising a first layer (A) that contains at least one organic infrared absorber and at least one ultraviolet absorber, and a second layer (B) that contains at least one ultraviolet absorber and is substantially free of organic infrared absorbers, and wherein layer (A) is the only layer that contains an organic infrared absorber.

3.4 Several structures are disclosed in D9 starting on page 4, line 12. The embodiment disclosed on page 5, lines 1 to 4, was seen by the opposition division as representing the closest prior-art embodiment. This embodiment is described as a thermoplastic sheet containing organic infrared absorber and UV absorber (layer (A)) coextruded on each side with a thin UV absorber layer (layers (B)), resulting in a (B)-(A)-(B)-type structure.

3.5 The appellant contested the choice of this embodiment by the opposition division because the skilled person had to make several choices within the broad teaching

of D9 to arrive at it. Furthermore, there was no working example of this embodiment in D9.

3.6 The board disagrees. According to the jurisprudence of the boards of appeal, the teaching of a document is not restricted to its preferred embodiments or those disclosed in the examples. There is therefore no reason to disregard the above embodiment as representing the closest prior art.

3.7 The claimed multilayered sheet essentially differs from this disclosure of D9 only in that the **organic** infrared absorber in the core layer has been replaced by an inorganic infrared absorber, namely a **boride**.

4. Problem to be solved and its solution

4.1 According to the appellant, the technical problem underlying the patent in view of D9 was the provision of a further passive design solution which would lead to reduced solar heat loads in automobiles as well as for residential and office buildings (see last paragraph of page 7 of the statement of grounds of appeal).

4.2 This problem is solved by the multilayered sheets of claim 1, wherein the core layer comprises a boride as an IR absorbing additive. The examples in the patent specification show that incorporating LaB_6 in the core layer results in multilayered sheets having good IR absorbing properties and low haze that can be effectively used in automobiles, residential and office housing (see paragraph [0095]).

4.3 It has not been contested by the respondents that this problem has been credibly solved, and the board itself is also satisfied that this is indeed the case.

5. Obviousness

5.1 It remains to be decided whether, in view of the available prior art, it would have been obvious for the skilled person to replace the organic infrared absorber used in D9 with a boride infrared absorber.

5.2 In the board's view this is indeed the case, because D7 gives the skilled person a clear hint in this direction. Thus on page 4346 (lines 20 to 27 of the left column) it states that:

> "NIR absorbing organic dyes are widely available but unstable under solar irradiance, while inorganic pigments introduce haze due to scattering. Now, however, the availability of nanoparticles and the ability to disperse them as individual particles in polymer, means it is possible to achieve high visible transmittance and NIR blocking without haze. This study indicates that LaB_6 approaches the ideal material for this purpose."

5.3 The person skilled in the art, starting from the multilayered sheets of D9, would find an incentive in this passage of D7 to use lanthanum boride (LaB_6) as IR absorber to solve the above-mentioned technical problem. In fact, it is mentioned as the ideal material for this purpose (see citation above).

In this context it should be added that D9 itself already makes a distinction between organic and

inorganic IR absorbers. It acknowledges in the background section that inorganic IR absorbers conventionally display a high light stability but have the disadvantage of being insoluble in thermoplastics and therefore form cloudy to opaque moulding compositions (page 2, lines 14 to 17). It is this drawback of the inorganic IR absorbers that is repeated in the paragraph of D7 cited above and is said to be solved by using LaB_6 nanoparticles. Therefore, the skilled person reading this paragraph of D7 would find an incentive to use this inorganic IR absorber in the sheets of D9 because it explicitly says that the disadvantage of the inorganic absorbers mentioned in D9 is solved by using this specific inorganic IR absorber.

5.4 The board cannot share the appellant's view that the skilled person would not have had any motivation to modify the multilayered structure of D9 in view of D7 because:

- (i) D9 is in the field of thermoplastic polymer-based glazing solutions, while D7 is in the field of conventional glass-based glazing solutions; and

- (ii) the only polymer used in D7 is polyvinyl butyral, which is totally different from the polycarbonates preferably used in D9.

5.5 Concerning (i), it is true that D7 studies the lanthanum boride in window samples consisting of a composite structure of two clear glass sheets with a nanoparticle-doped polyvinyl butyral (PVB) laminate sheet sandwiched between them (page 4346, right column, first full paragraph). However, the board agrees with the respondents that the skilled person would not be deterred from consulting D7 by the fact that it relates

to a glass-based structure. The two systems, namely conventional glazing systems made from glass and glazing systems made from compositions containing transparent thermoplastics, are very close and in fact neighbouring fields. The skilled person would therefore not discard D7.

5.6 Concerning (ii), the board notes that the preferred materials for the sheets of D9 are transparent thermoplastic polymers (see page 9, line 26) and that polyvinyl butyral as used in D7 is a thermoplastic polymer. In view of this, the skilled person would not be at all discouraged from combining the two documents.

6. For these reasons, the board concludes that the person skilled in the art would have arrived in an obvious manner at the subject-matter of claim 1 of the main request, which therefore lacks an inventive step.

AUXILIARY REQUESTS 1, 1a and 1b

7. The appellant filed these requests in order to further distinguish the claimed subject-matter from the disclosure of D9 and/or D7.

7.1 Thus, claim 1 of auxiliary request 1 specifies that the thermoplastic polymers used are polycarbonates, claim 1 of auxiliary request 1a further defines the boride used, its particle size and the amount used, and claim 1 of auxiliary request 1b specifies that the IR absorbing additive is lanthanum boride (LaB_6).

7.2 However, these additional features do not change anything with regard to inventive step because these same features are disclosed in D9 or D7. Indeed, polycarbonates are the preferred thermoplastic polymers

used in D9 (see page 10, line 14), and lanthanum boride having a particle size in the range of 20 to 200 nm is the IR absorber used in D7 (see page 4346, second full paragraph, lines 7 to 8). Lastly, the amount of absorber also falls within the range disclosed in D9 (see page 8, lines 7 to 9).

7.3 In the absence of any evidence that these features lead to any unexpected effect, the objective technical problem remains the same, namely the provision of a further (alternative) multilayered sheet in addition to those disclosed in D9. For the same reasons as given above with regard to the main request, the skilled person looking for such an alternative sheet would turn to D7 and would use the lanthanum boride to replace the organic IR absorber of D9, thus arriving at the subject-matter of claim 1 of these requests.

7.4 Therefore the subject-matter of claim 1 of auxiliary requests 1, 1a and 1b lacks an inventive step.

AUXILIARY REQUESTS 2 TO 6

8. As for auxiliary requests 1, 1a and 1b, the appellant filed these requests in order to distinguish the claimed subject-matter from the disclosure of D9, now using different features, namely the thickness of the core layer, the thickness of the cap layers and/or the use of thermal stabilisers (see claim 1 of these requests on pages 5 and 6 above).

8.1 The respondents argued that these additional features did not change anything with regard to inventive step because they were known from D9.

8.2 Thus, the claimed thickness of 1 to 30 mm for the core layer overlaps in part with the thickness of the core layer used in D9, namely 2 to 8 mm (see page 5, line 30), and the claimed thickness for the cap layers of 10 to 120 micrometres (auxiliary request 3) or 15 to 100 micrometres (auxiliary request 4) overlaps with the thickness of 1 to 100 micrometres disclosed in D9 (see page 6, line 2). Lastly, conventional thermal stabilisers such as phosphites and phosphines as claimed in auxiliary requests 5 and 6 are also used in D9 (see page 15, lines 26 to 29).

In the absence of any evidence that any of these features is linked to any unexpected effect, the board considers it within the competence of the skilled person to maintain these features known from D9 into the claimed sheets.

8.3 Thus, the subject-matter of auxiliary requests 2 to 6 suffers from the same deficiency under Article 56 EPC as the main request, and these requests are likewise refused.

9. In summary, none of the appellant's requests is allowable.

Order

For these reasons it is decided that:

The appeal is dismissed

The Registrar: The Chairman:

M. Cañueto Carbajo W. Sieber

Decision electronically authenticated