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**D E C I S I O N**  
of 12 October 2001

**Case Number:** T 0045/00 - 3.3.3

**Application Number:** 96912833.9

**Publication Number:** 0822962

**IPC:** C08L 67/02

**Language of the proceedings:** EN

**Title of invention:**  
Blends of ultraviolet absorbers and polyesters

**Applicant:**  
EASTMAN CHEMICAL COMPANY

**Opponent:**  
-

**Headword:**  
-

**Relevant legal provisions:**  
EPC Art. 56

**Keyword:**  
"Inventive step (yes)"

**Decisions cited:**  
-

**Catchword:**  
-



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Boards of Appeal

Chambres de recours

Case Number: T 0045/00 - 3.3.3

**D E C I S I O N**  
of the Technical Board of Appeal 3.3.3  
of 12 October 2001

**Appellant:** EASTMAN CHEMICAL COMPANY  
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**Representative:** Wibbelmann, Jobst, Dr., Dipl.-Chem.  
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**Decision under appeal:** Decision of the Examining Division of the  
European Patent Office posted 16 July 1999  
refusing European patent application  
No. 96 912 833.9 pursuant to Article 97(1) EPC.

**Composition of the Board:**

**Chairman:** R. Young  
**Members:** C. Idez  
J. De Preter

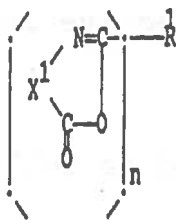
### Summary of Facts and Submissions

- I. European patent application No. 96 912 833.9, based on International patent application PCT/US96/05299, filed on 18 April 1996, claiming the priority of the earlier US patent application No. 430 662 of 28 April 1995, and published under No. WO 96/34056 on 31 October 1996, was refused by a decision of the Examining Division issued in writing on 16 July 1999.
- II. The decision was based on a set of 29 claims submitted with a letter dated 3 March 1999.

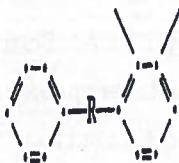
Claim 1 read as follows:

"A photo-stabilized polymer blend comprising:

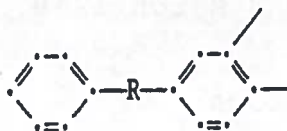
- (a) at least one polyethylene terephthalate-based copolymer comprising 1,4-cyclohexane-dimethanol, and
- (b) an ultraviolet absorber, at least one compound selected from the group consisting of cyclic imino esters represented by the following formula (I)



wherein X<sup>1</sup> represents 1,2-phenylene, 1,2-naphthylene, 2,3-naphthylene, a group represented by the formula (a)



wherein R is -O-, -CO-, -S-, -SO<sub>2</sub>-, -CH<sub>2</sub>-, -(CH<sub>2</sub>)<sub>2</sub>- or -C(CH<sub>3</sub>)<sub>2</sub>-, or a group represented by the formula (b)



wherein R is as defined above, and n is 1, 2 or 3, and R<sup>1</sup> represents a hydrocarbon residue having a valence of n."

Dependent Claims 2 to 18 referred to specific embodiments of the blend according to Claim 1.

Independent Claim 19 read as follows:

"A photo-stabilized protective layer comprising the blend of Claim 1."

Independent Claim 20 read as follows:

"A method for protecting from ultraviolet light a molded article of a polymer whose deterioration by ultraviolet light is required to be retarded or prevented, which comprises applying to said polymer article an amount, effective for retarding or preventing said ultraviolet deterioration, of the polymer blend of Claim 1."

Independent Claim 21 read as follows:

"A method for protecting from ultraviolet light an object subject to deleterious effects under ultraviolet light, which comprises substantially shielding said object from ultraviolet light by means of application thereto of the polymer blend of Claim 1."

Dependent Claims 22 to 26 and dependent Claims 27 to 29 referred to preferred features of, respectively, the method according to Claim 21 and the method according to Claim 20.

III. The Examining Division refused the application on the ground that the subject-matter of Claims 1 to 29 did not meet the requirements of Article 56 EPC. More precisely, the decision held that, starting from D1 (US-A-5 251 064) or D2 (US-A-4 446 262), the technical problem underlying the application was to provide further polyester compositions being stabilized with cyclic imino esters. Since it was known from the documents DE-A-2 853 631 (D3) and EP-A-0 595 413 (D4), that polyethylene terephthalate (PET) could be copolymerized with 1,4-cyclohexane dimethanol (CHDM), it was obvious to combine the teachings of D1 or D2 with both documents and thus to come to the claimed solution. In the absence of any unexpected effects, the mere combination of the teachings of these documents could not be considered as inventive.

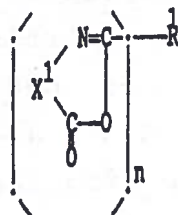
IV. A Notice of Appeal against the above decision was lodged on 14 September 1999 by the Appellant (Applicant). The prescribed fee was paid on the same date.

With the Statement of Grounds of Appeal filed on 10 November 1999, the Appellant submitted a new set of 22 claims as well as an experimental report.

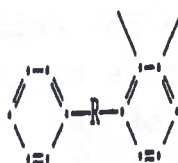
Claim 1 reads as follows:

"A photo-stabilized polymer blend comprising:

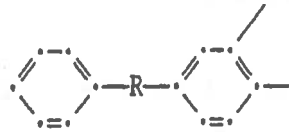
- (a) at least one polyethylene terephthalate-based copolymer comprising 1,4-cyclohexane-dimethanol wherein said 1,4-cyclohexanedimethanol is present in said copolymer in the amount of 5 to 35 mole %, and
- (b) an ultraviolet absorber, at least one compound selected from the group consisting of cyclic imino esters represented by the following formula (I)



wherein X<sup>1</sup> represents 1,2-phenylene, 1,2-naphthylene, 2,3-naphthylene, a group represented by the formula (a)



wherein R is -O-, -CO-, -S-, -SO<sub>2</sub>-, -CH<sub>2</sub>-, -(CH<sub>2</sub>)<sub>2</sub>- or -C(CH<sub>3</sub>)<sub>2</sub>-, or a group represented by the formula (b)



wherein R is as defined above, and n is 1, 2 or 3, and R<sup>1</sup> represents a hydrocarbon residue having a valence of n."

Dependent Claims 2 to 14 refer to specific embodiments of the blend according to Claim 1.

Independent Claim 15 reads as follows:

"A photo-stabilized protective layer comprising the blend of Claim 1."

Independent Claim 16 reads as follows:

"A method for protecting from ultraviolet light a molded article of a polymer whose deterioration by ultraviolet light is required to be retarded or prevented, which comprises applying to said polymer article an amount, effective for retarding or preventing said ultraviolet deterioration, of the polymer blend of Claim 1."

Independent Claim 17 reads as follows:

"A method for protecting from ultraviolet light an object subject to deleterious effects under ultraviolet light, which comprises substantially shielding said object from ultraviolet light by means of application thereto of the polymer blend of Claim 1."

Dependent Claims 18 to 22 deal with preferred features of the method according to Claim 17.

The arguments presented by the Appellant in the Statement of Grounds of Appeal may be summarized as follows:

- (i) The experimental report concerning outdoor weathering showed that a copolymer containing 3.5 mole % of CHDM exhibited a 100% brittleness failure after weathering, although it might still have an acceptable color. It also showed that a copolymer comprising 62 mole % of CHDM was unsatisfactory both in mechanical and optical properties. It could also be inferred from the experimental report that blends according to the application in suit provided both an improvement of mechanical and optical properties over blends of copolymers outside the claimed range of CHDM.
- (ii) Moreover, the experimental report showed that the use of cyclic imino esters as UV absorbers for the specific copolymers led to an unexpected improvement of the optical and mechanical properties over the use of benzotriazole UV absorbers.
- (iii) These effects could not have been inferred from the prior art. Therefore, the inventiveness of the subject-matter of the application in suit had been established.

V. The Applicant requested that the decision be set aside and the case be remitted to the first instance with the order to grant a patent on the basis of Claims 1 to 22 submitted with the Statement of Grounds of Appeal and a yet to be adapted description. As an auxiliary request oral proceedings were requested.



## Reasons for the Decision

1. The appeal is admissible.

2. Amendments

2.1 Claim 1 differs from Claim 1 as originally filed by the indication that 1,4-cyclohexanedimethanol is present in the polyethylene terephthalate-based copolymer in an amount of 5 to 35 mole %.

2.2 This amendment is supported by Claim 14 as originally filed.

2.3 Claims 2 to 11 and Claims 12 to 22 are respectively supported by Claims 2 to 11 and Claims 16 to 26 as originally filed.

2.4 Thus, Claims 1 to 22 meet the requirements of Article 123(2) EPC.

3. Novelty

The subject-matter of Claims 1 to 29 of the set of claims on which the decision under appeal was based was held to be novel by the Examining Division. The Board takes the same view for the subject-matter of Claims 1 to 22, the subject-matter of which has been further limited compared with that of the request on which the decision under appeal was based.

4. Closest prior art, technical problem and its solution.

4.1 The application in suit concerns photo-stabilized polyester compositions on the basis of PET/CHDM copolymers.

- 4.2 Such compositions are known from D3 and D4.
- 4.3 D3 relates to stabilized polyester compositions comprising a polyester obtained from terephthalic acid, 50 to 99 mole % CHDM and 1 to 50 mole % of a second glycol selected from ethylene glycol, 1,4-butanediol and 2,2-dimethyl-1,3-propanediol and a stabilizer selected from specific 2-hydroxyphenylbenzotriazoles, 2-hydroxybenzophenones, or alkoxyphenylethylene compounds. D3 shows that the addition of these UV stabilizers to PET/CHDM copolymers leads to an improvement of the weathering resistance (in terms of maintenance of impact resistance), only when the amount of CHDM in the copolymer is at least 50 mole % (cf. D3; Claim 1; page 9, line 31 to page 13, line 8; Figure 1).
- 4.4 D4 refers to plastic sheet containing a copolymer, which copolymer is obtainable by reacting dimethyl terephthalate or terephthalic acid with a mixture of 95 to 70 mole % ethylene glycol and 5 to 30 mole % CHDM, characterized in that at at least one surface of the sheet a layer with a thickness of 2 to 100  $\mu\text{m}$  is present, which layer also contains the copolymer and a UV light absorbing additive such as benzotriazole or a benzophenone compound. The aim of the use of the thin protecting layer is to improve the weathering resistance of the sheet in terms of transparency, light transmittance and toughness. D4 also shows that sheets made of a composition comprising a benzotriazole UV absorber but free of protective layers exhibit an unacceptable yellowness (cf. D4, Claims 1, 4, 5; Examples 1 and 2; Comparative Examples A, B, C; Tables 1 to 4).

4.5 In the Board's view, Figure 1 of D3, which exemplifies blends comprising a copolymer of polyethylene terephthalate with CHDM in an amount between 28 and 30 mole % and a benzotriazole UV absorber, qualifies as the closest state of the art.

4.6 Starting from Figure 1 of D3, the technical problem underlying the application in suit may be seen in the provision of UV stabilized blends of copolymers of polyethylene terephthalate with 5 to 35 mole % CHDM exhibiting a good color stabilization (resistance to yellowness) and having an improved retention of impact resistance.

4.7 The solution proposed according to Claim 1 of the application in suit is the use of a cyclic imino ester of formula (I) as UV absorbers in the specific copolyesters of polyethylene terephthalate with 5 to 35 mole % CHDM.

4.8 It can be seen, in particular, from Example 2 of the application in suit, and from the experimental report submitted with the Statement of Grounds of Appeal, that the claimed measure provides an effective solution of the technical problem, since the claimed compositions exhibit an improved retention of impact strength and a good color stabilization after weathering.

5. *Inventive step*

5.1 It remains to be decided whether this solution was obvious to a person skilled in the art having regard to the cited prior art.

- 5.2 Neither D3 nor D4 mentions the use of the specific UV absorbers of formula (I) according to the application in suit. Furthermore, D4 shows that the direct stabilization of a sheet made of a PET/CHDM copolymer (i.e. without protective layers) with UV absorbers results in an unacceptable yellowness thereof. Thus, these documents cannot suggest the solution of the technical problem.
- 5.3 D2 relates to photo-stabilized polymer compositions comprising a polymer and an ultraviolet absorber selected from cyclic imino esters and having the same formula as those used in the application in suit. As indicated in D2, many ultraviolet absorbers such as benzophenone compounds or benzotriazole compounds do not exhibit a satisfactory heat or oxidation resistance, or they have the defect that they sublime at high temperature or bleed out into the surface of the materials during use. D2 indeed mentions that the specific UV cyclic imino esters absorbers have an excellent stability to heat or oxidation, a reduced sublimability and an excellent compatibility with polymers, but D2 is totally silent as whether the use of these specific absorbers would improve the weathering resistance in terms of retention of impact strength of compositions containing them in comparison to the use of UV absorbers such as benzotriazoles (cf. D2; column 1, lines 29 to 65). To this extent, D2 does not address the relevant technical problem (cf. section 4.6, above). Furthermore, D2 only refers in broad terms to the use of these specific absorbers in aromatic polyester compositions (cf. D2, column 8, lines 21 to 48). Consequently, it could not be inferred that they would be efficient in compositions comprising the specific polyester copolymers according to the application in suit for improving the retention of impact strength. On the contrary, as evidenced by D3 (cf D3, page 12, line 30 to page 13, line 8, Figure 1),

the efficiency of UV absorbers in PET/CHDM copolymers drastically and unforeseeably varies with the amount of CHDM in the copolymer. Thus, there is no hint to the solution of the technical problem in D2.

- 5.4 The disclosure of D1, which expressly refers to D2, merely relates to the incorporation of these cyclic imino esters UV absorbers in a flexible polyester sheet carrying a vacuum-deposited layer of reflective silver metal in order to prevent the degradation of the bond between polyester and metal caused by ultraviolet radiation (cf. D1, Claims 1 to 7; column 2, lines 55 to column 4, line 9). Thus, D1 does not add anything to the disclosure of D2.
- 5.5 In summary, the solution of the technical problem does not arise in an obvious way from the state of the art. Consequently, the subject-matter of Claim 1 involves an inventive step within the meaning of Article 56 EPC.
6. As Claim 1 is allowable, the same is valid for dependent Claims 2 to 14, the patentability of which is supported by that of Claim 1.
7. The same considerations also apply to Claims 15 to 22 since their subject-matter is based on the same combination of features as that of Claim 1.
8. In view of the above, the main request of the Appellant is allowable and there is, thus, no need to hold oral proceedings.

**Order**

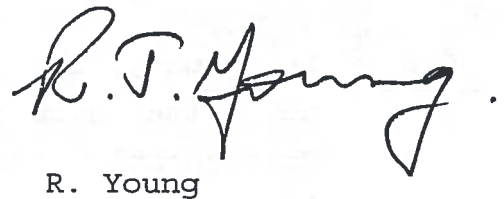
**For these reasons it is decided that:**

1. The decision under appeal is set aside.
  
2. The case is remitted to the first instance with the order to grant a patent on the basis of Claims 1 to 22 filed on 10 November 1999, and after any necessary consequential amendment of the description.

The Registrar:

  
E. Gorgmayer

The Chairman:

  
R. Young