

**Internal distribution code:**

- (A) [ ] Publication in OJ  
(B) [ ] To Chairmen and Members  
(C) [X] To Chairmen  
(D) [ ] No distribution

**Datasheet for the decision  
of 28 September 2007**

**Case Number:** T 0824/05 - 3.3.03

**Application Number:** 95943832.6

**Publication Number:** 0746581

**IPC:** C08G 63/82

**Language of the proceedings:** EN

**Title of invention:**

Production of particular polyesters using a novel catalyst system

**Patentee:**

EASTMAN CHEMICAL COMPANY

**Opponent:**

Mitsubishi Chemical Corporation

**Headword:**

-

**Relevant legal provisions:**

-

**Relevant legal provisions (EPC 1973):**

EPC Art. 54, 56, 123(2)

**Keyword:**

"Novelty - yes (main request)"

"Inventive step - no (main request)"

"Amendments - added subject-matter - yes (auxiliary request 2)"

**Decisions cited:**

-

**Catchword:**

point 6.2 of the reasons



Case Number: T 0824/05 - 3.3.03

**D E C I S I O N**  
of the Technical Board of Appeal 3.3.03  
of 28 September 2007

**Appellant:** Mitsubishi Chemical Corporation  
(Opponent) 14-1, Shiba 4-chome  
Minato-ku  
Tokyo  
108-0014 (JP)

**Representative:** HOFFMANN EITLE  
Patent- und Rechtsanwälte  
Arabellastrasse 4  
D-81925 München (DE)

**Appellant:** EASTMAN CHEMICAL COMPANY  
(Proprietor) 100 North Eastman Road  
Kingsport, TN 37660 (US)

**Representative:** Best, Michael  
Lederer & Keller  
Patentanwälte  
Prinzregentenstrasse 16  
D-80538 München (DE)

**Decision under appeal:** Interlocutory decision of the Opposition  
Division of the European Patent Office posted  
10 May 2005 concerning maintenance of European  
patent No. 0746581 in amended form.

**Composition of the Board:**

**Chairman:** R. Young  
**Members:** W. Sieber  
E. Dufrasne

## Summary of Facts and Submissions

I. The mention of the grant of European patent No. 0 746 581, in respect of European patent application no. 95 943 832.6, based on International application PCT/US95/16378, in the name of Eastman Chemical Company, filed on 14 December 1995 and claiming an US priority of 22 December 1994 (US 362387), was published on 8 May 2002 (Bulletin 2002/19). The granted patent contained 28 claims, whereby Claims 1 and 27 read as follows:

"1. A process of producing a moldable polyethylene terephthalate or modified polyethylene terephthalate having an inherent viscosity greater than 0.65 dL/g comprising:

reacting a diacid component further comprising at least 65 mole % terephthalic acid or a diester component comprising at least 65 mole % C<sub>1</sub> - C<sub>4</sub> dialkyl terephthalate and a diol component comprising at least 65 mole % ethylene glycol at temperatures to effect steps (A) and (B) as follows:

(A) esterification or transesterification, wherein said esterification is carried out, optionally, in the presence of 1 to 50 parts of titanium present in the form of an alkyl titanate or optionally, in the presence of a catalyst system comprising from 1 to 50 parts of titanium present in the form of an alkyl titanate and from 1 to 100 parts of phosphorus in the form of a phosphate ester or phosphoric acid, and

wherein said transesterification is carried out in the presence of from 1 to 50 parts of titanium in the form of an alkyl titanate; and

(B) polycondensation, wherein said polycondensation is carried out in the presence of a catalyst system comprising from 1 to 50 parts of titanium present in the form of an alkyl titanate and from 1 to 100 parts of phosphorus in the form of a phosphate ester or phosphoric acid;

each of the parts of the catalyst representing per million parts of polymer product, wherein the mole percentage for all of the diacid component totals 100 mole %, and wherein the mole percentage for all of the diol component totals 100 mole %.

27. A molded article prepared from moldable poly(ethylene terephthalate) made by the process of any one of Claims 1 to 21."

Claims 1-24 and 26 were dependent claims directed to preferred embodiments of the process of Claim 1. Claim 25 was an independent claim directed to a method for imparting clarity to polyethylene terephthalate or modified polyethylene terephthalate. Claim 28 was a preferred embodiment of the moulded article of Claim 27.

II. A notice of opposition was filed by Mitsubishi Chemical Corporation on 10 February 2003 requesting revocation of the patent in its entirety. The Opponent opposed the patent on the grounds of Article 100 (a) EPC (lack of novelty and lack of inventive step).

The following documents were *inter alia* cited during the opposition procedure:

D1: JP-A-6-100679 (an English translation of relevant parts thereof was provided);

D2: US-A-4 010 145; and

D3: JP-A-4-270727 (an English translation of relevant parts thereof was provided).

III. By an interlocutory decision which was announced orally on 13 April 2005 and issued in writing on 10 May 2005, the Opposition Division maintained the patent in amended form based on the claims of the Proprietor's modified auxiliary request 2 filed at the oral proceedings of 13 April 2005.

Claim 1 of modified auxiliary request 2 corresponded to Claim 1 as granted except that the following amendments had been carried out in reaction steps (A) and (B) (amendments underlined):

"(A) esterification or transesterification, wherein said esterification is carried out, optionally, in the presence of 3 to 10 parts of titanium present in the form of an alkyl titanate or optionally, in the presence of a catalyst system comprising from 3 to 10 parts of titanium present in the form of an alkyl titanate and from 5 to 15 parts of phosphorus in the form of a phosphate ester or phosphoric acid, and

wherein said transesterification is carried out in the presence of from 3 to 10 parts of titanium in the form of an alkyl titanate; and

(B) polycondensation, wherein said polycondensation is carried out in the presence of a catalyst system comprising from 3 to 10 parts of titanium present in the form of an alkyl titanate and from 5 to 15 parts of phosphorus in the form of a phosphate ester or phosphoric acid;"

According to the decision of the Opposition Division, the amendments in Claim 1 of modified auxiliary request 2 met the requirements of Article 123(2) and (3) EPC. The subject-matter of Claim 1 was also novel over the relevant prior art documents, namely D1-D3. As regards inventive step, the Opposition Division was of the opinion that, starting from D1, the objective technical problem was to provide an alternative process for the preparation of transparent, mouldable polyethylene terephthalate. There was no indication in the prior art that a catalyst comprising 3 to 10 ppm of titanium and 5 to 15 ppm phosphorus would solve this problem. Hence, the subject-matter of Claim 1 involved an inventive step.

IV. Notices of appeal against the above decision were filed by the Opponent (Appellant Opponent) on 29 June 2005 and by the Proprietor (Appellant Proprietor) on 7 July 2005, the prescribed fee being paid on the respective same days.

V. With its statement of grounds of appeal, filed on 15 September 2005, the Appellant Opponent filed the following documents:

D1: replacement translation of D1 (coded D1r);

D3a: translation of additional portions of D3; and

D11: JP-A-6 220173 and a partial English translation thereof.

The arguments presented in the statement of grounds of appeal may be summarized as follows:

- (a) Example 5 of D3 anticipated at least the subject-matter of Claim 1 as maintained by the opposition division. The polyethylene terephthalate (PET) was produced in Example 5 of D3 by means of an initial esterification reaction followed by a polycondensation reaction of the resulting polyester oligomer. Its catalyst system included tetra-n-butyl orthotitanate and triethyl phosphate which provided Ti and P contents respectively of 5 and 7.5 ppm based on the polyester product. Whilst no inherent viscosity value was specified for the PET product of Example 5, it was reasonable to assume that this would satisfy the corresponding parameter in Claim 1 given that all the other reaction conditions used in D3 were the same as those used in the patent in suit. Further, the intrinsic viscosity of the polyester which was produced in "the same manner" in Example 1 of D3 was stated to be 0.65 dL/g.

- (b) If novelty was to be acknowledged, the subject-matter of Claim 1 as maintained by the Opposition Division was rendered obvious by D3 if D3 was taken as being the closest prior art.

Independently of that, the subject-matter was rendered obvious starting from D1 as the closest prior art. The Opposition Division correctly identified the technical problem tackled by the alleged invention as being to provide an alternative process for producing mouldable PET. However, contrary to the decision under appeal, D3 already taught low amounts of titanium and phosphorus in the production of mouldable PET. Furthermore, a skilled person would have reason to investigate performing the process of D1 using reduced contents of titanium and phosphorus catalysts due to existing environmental pressure. D11 provided yet further evidence that it was quite obvious to a skilled person to use relatively low amounts of titanium and phosphorus catalysts to produce mouldable polyesters. Example 1 of D11 taught the production of PET having an intrinsic viscosity of around 0.70 dL/g which was formed into bottles having good colour tone and haze characteristics. The PET was produced in a two-step reaction, namely an ester interchange reaction followed by a polycondensation. The ester interchange reaction was carried out in the presence of titanium acetate whereas the polycondensation reaction was carried out in the presence of the same catalyst together *inter alia* with orthophosphoric acid. The respective amounts of titanium and phosphorus were



7.1 and 20 ppm based upon the oligomer starting material. Although D11 used titanium acetate rather than an alkyl titanate this difference had no real technical significance.

VI. A statement setting out the grounds of appeal and including a main request and auxiliary request 1-4 was filed by the Appellant Proprietor on 20 September 2005. The arguments presented may be summarized as follows:

Document D1 was considered to represent the closest prior art. As correctly stated by the Opposition Division, it required at least three selections from the broad disclosure of D1 in order to arrive at the subject-matter of Claim 1 of the main request, namely the selection of a certain amount of titanium, a certain amount of phosphorus and the selection of a certain type of phosphorus-containing compound. Comparative experiments (D12) were submitted in order to demonstrate that these three selections significantly improved the colour of the obtained PET, unexpectedly reduced the haze half-time and lowered the acetaldehyde generation. There was no suggestion anywhere in D1 or the other documents which suggested the claimed combination of features in order to provide these particularly favourable properties. Thus, claims being broader in scope than those maintained by the Opposition Division were justified.

VII. With a letter dated 3 February 2006, the Appellant Opponent submitted a complete English translation of D11. Hereinafter, this complete English translation will be adopted as D11.

Furthermore, the Appellant Opponent elucidated on its novelty and inventive step objections and commented on the comparative experiments D12.

VIII. With a letter dated 6 April 2006, the Appellant Proprietor filed a main request and auxiliary requests 1-9 whereby the main request and auxiliary requests 1-3 and 8 corresponded to the requests filed with the statement of grounds of appeal.

The Appellant Proprietor underlined its position that the subject-matter of all requests was novel over D3, in particular Example 5 of D3, because D3 disclosed film-grade PET rather than "mouldable" PET. In addition, Example 5 of D3 did not disclose the inherent viscosity of the PET produced. D3 could also not be considered as the closest prior art. In fact, the closest prior art was D1 which was, as the patent in suit, in the field of mouldable PET.

As regards D11, the Appellant Proprietor noted that this document used an acyl compound as titanium catalyst for the transesterification reaction and a different catalyst for the polycondensation reaction, namely a treated germanium dioxide. A combination of D11 with the closest prior art D1 appeared to be not free from hindsight.

IX. In a letter dated 21 August 2006, the Appellant Opponent requested that the Board should exercise its discretion and refuse to admit auxiliary requests 4-7 and 9 of the Appellant Proprietor into the proceedings in accordance with Article 10 of the Rules of Procedure of the Boards of Appeal.

The Appellant Opponent maintained its view that the subject-matter of the majority of the requests was not only anticipated by D3 but also rendered obvious thereby. As regards D11, it was quite clear that the organic titanium catalyst was retained from the transesterification reaction and present during the polycondensation in D11. Comparing the alleged invention with D11, the only distinction was the use of an alkyl titanate as the catalytic component in the patent in suit in contrast to the use in D11 of an acyl titanium compound. Such a compound did not seem to be so different from the titanium compound used in Example 4 of the patent in suit, namely acetyltriisopropyl titanate.

X. In a letter dated 24 August 2007, the Appellant Proprietor argued that all claim requests were filed in response to the grounds of appeal invoked by the Appellant Opponent and should therefore be admitted into the proceedings. Furthermore, it provided some further comments on the issue of added subject-matter (relevant to various requests), D3, D11 and the comparative experiments D12.

XI. On 28 September 2007, oral proceedings were held before the Board.

(c) The Appellant Opponent raised a novelty objection in view of D3 against the subject-matter claimed in the main request filed on 6 April 2006. The discussion focussed on the questions as to whether or not the term "mouldable" used in Claim 1 and a not properly defined parameter, namely an inherent

viscosity of greater than 0.65 dl/g, could provide novelty over Example 5 of D3. Following this discussion, the Appellant Proprietor withdrew the main request, auxiliary request 1 and auxiliary request 2, all filed on 6 April 2006.

- (d) As regards auxiliary request 3, the Appellant Opponent argued that the restriction in Claim 1 to a process of producing a mouldable polyethylene terephthalate having an inherent viscosity of greater than 0.70 dl/g and simultaneously being produced using a catalyst system comprising from 1-20 parts titanium and 1-50 parts of phosphorus contravened Article 123(2) EPC because this particular combination had not been disclosed in the application as originally filed.

Furthermore, the Appellant Opponent argued during the discussion of D11 that the subject-matter of Claim 1 of auxiliary request 3 lacked novelty over Comparative Example 3 of D11. In view of this objection, the Appellant Proprietor withdrew also auxiliary request 3 and filed a new main request.

- (e) Claim 1 of the new main request read as follows:

"A process of producing a moldable polyethylene terephthalate or modified polyethylene terephthalate having an inherent viscosity greater than 0.70 dL/g comprising:

reacting a diacid component further comprising at least 65 mole % terephthalic acid and a diol component comprising at least 65 mole % ethylene

glycol at temperatures to effect steps (A) and (B) as follows:

(A) esterification, wherein said esterification is carried out, optionally, in the presence of 1 to 20 parts of titanium present in the form of an alkyl titanate or optionally, in the presence of a catalyst system comprising from 1 to 20 parts of titanium present in the form of an alkyl titanate and from 1 to 50 parts of phosphorus in the form of a phosphate ester or phosphoric acid,

(B) polycondensation, wherein said polycondensation is carried out in the presence of a catalyst system comprising from 1 to 20 parts of titanium present in the form of an alkyl titanate and from 1 to 50 parts of phosphorus in the form of a phosphate ester or phosphoric acid;

each of the parts of the catalyst representing per million parts of polymer product, wherein the mole percentage for all of the diacid component totals 100 mole %, and wherein the mole percentage for all of the diol component totals 100 mole %."

Claims 2-27 corresponded to Claims 2-8 and 10-28 as granted with the back references amended where necessary. Furthermore, Claims 2, 13, 24 and 25 were amended in accordance with new Claim 1.

- (f) The Appellant Opponent raised a novelty objection against Claim 26 of the new main request ("A molded article prepared from moldable poly(ethylene terephthalate) made by the process

of any one of Claims 1 to 20.") in view of Comparative Example 3 of D11. The subject-matter of Claim 26 being in the form of a "product-by-process" claim could not be distinguished from the bottle prepared in this example of D11.

The Appellant Proprietor argued that the article claimed in Claim 26 was prepared from a PET which had been prepared via direct esterification. In contrast, the PET used in Comparative Example 3 of D11 was prepared via transesterification. The process according to Claim 1 yielded a PET that differed in the polymer end groups from the PET obtained in Comparative Example 3 of D11. These end groups could still be detected in the final article, for example, by NMR end group analysis.

As regards inventive step, the discussion focussed on the question whether D11 (as argued by the Appellant Opponent) or D1 (as argued by the Appellant Proprietor) had to be considered as the closest prior art.

According to the Appellant Opponent, starting from D11 as the closest prior art, the subject-matter of Claim 1 of the new main request was rendered obvious from D11. The Appellant Proprietor raised no objection against this line of argumentation although D11 was used for the first time as the closest prior art. However, according to the Appellant Proprietor, D11 was not the appropriate starting point for the assessment of inventive step.

(g) Following the discussion of the new main request, the appellant proprietor withdrew auxiliary requests 4-7.

(h) Claim 1 of auxiliary request 8 read as follows:

"A process of producing a moldable polyethylene terephthalate or modified polyethylene terephthalate having an inherent viscosity greater than 0.65 dL/g comprising:

reacting a diacid component further comprising at least 65 mole % terephthalic acid or a diester component comprising at least 65 mole % C<sub>1</sub> - C<sub>4</sub> dialkyl terephthalate and a diol component comprising at least 65 mole % ethylene glycol at temperatures to effect steps (A) and (B) as follows:

(A) esterification or transesterification, wherein said esterification is carried out, optionally, in the presence of 1 to 20 parts of titanium present in the form of an alkyl titanate or optionally, in the presence of a catalyst system comprising from 1 to 20 parts of titanium present in the form of an alkyl titanate and from 1 to 50 parts of phosphorus in the form of a phosphate ester or phosphoric acid, and wherein said transesterification is carried out in the presence of from 1 to 20 parts of titanium in the form of an alkyl titanate; and

(B) polycondensation, wherein said polycondensation is carried out in the presence of a catalyst system consisting of

1 to 20 parts of titanium present in the form of an alkyl titanate,

1 to 50 parts of phosphorus in the form of a phosphate ester or phosphoric acid,

optionally an inorganic toner consisting of salts of cobalt and

optionally an organic toner system comprising 1 to 10 ppm of at least one copolymerizable 6-arylamino-1-cyano-3H-dibenz[f,ij]isoquinoline-2,7-dione or at least one copolymerizable 1,4-bis(2,6-dialkylanilino)anthraquinone compound in combination with at least one copolymerizable anthraquinone or red anthrapyridone (6-arylamino-3H-dibenz[f,ij]isoquinoline-2,7-dione) compound, wherein the organic toners contain at least one, preferably two polyester reactive groups;

each of the parts of the catalyst representing per million parts of polymer product, wherein the mole percentage for all of the diacid component totals 100 mole %, and wherein the mole percentage for all of the diol component totals 100 mole %."

As regards auxiliary request 8, the Appellant Opponent argued that it was well recognised that the expression "consisting of" defined a so-called closed composition. The originally filed



application nowhere taught such a closed composition. Furthermore, the Appellant Opponent pointed out that Claim 1 of auxiliary request 8 included now the possibility that both a specific inorganic toner and a specific organic toner could be present whereas the application as originally filed referred to the presence of an inorganic or an organic toner.

- (i) Following the discussion of the amendments in Claim 1 of auxiliary request 8, the Appellant Proprietor withdrew auxiliary request 9 filed on 6 April 2006.

XII. The appellant proprietor requested that the decision under appeal be set aside and that the patent be maintained on the basis of the main request (Claims 1-27), filed at the oral proceedings, or, in the alternative, on the basis of auxiliary request 8 (Claims 1-26), filed with the letter dated 6 April 2006.

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

### **Reasons for the Decision**

1. The appeals comply with Articles 106 and 108 EPC and Rule 64 EPC and are therefore admissible.

*Main request*

2. *Procedural matter (main request)*

2.1 The Board was confronted at a very late stage of the proceedings with the filing of a new request, ie a new main request was filed at the oral proceedings of 28 September 2007 (point XI(b), above). The necessity of further restricting the claimed subject-matter had become apparent during the discussion of document D11, in particular Comparative Example 3 of D11.

2.2 If, as in the present case, it turns out for the first time during the oral proceedings that a particular example is novelty destroying to the subject-matter of the main request then on file, it is a question of procedural fairness to allow the Appellant Proprietor to amend its main request accordingly. Since, furthermore, the subject-matter of Claim 1 of the new main request was merely further restricted, the Board was satisfied that the other party could properly deal with the late filed request. Consequently, the main request was admitted into the proceedings for consideration.

3. *Amendments (main request)*

3.1 Claim 1 of the main request (point XI(c), above) differs from Claim 1 as granted in that

- (1) transesterification as a possible reaction mechanism has been deleted from the claim (which included the deletion of the diester starting component),

(2) the inherent viscosity of the polyethylene terephthalate has been restricted to greater than 0.70 dl/g, and

(3) the amount of titanium and phosphorus has been restricted to 1-20 and 1-50 parts per million parts of polymer product, respectively.

3.2 Claim 1 as granted (and Claim 1 as originally filed, respectively) foresaw two alternative reaction types, namely esterification or transesterification. In Claim 1 of the main request, the alternative "transesterification" has been deleted. Thus, no objection under Article 123(2) EPC arises against amendment (1). Nor did the appellant opponent raise any objection in this respect.

3.3 It is stated in paragraph [0021] of the patent specification that the invention involves a process of producing a mouldable polyethylene terephthalate or modified polyethylene terephthalate having an inherent viscosity greater than 0.65 dl/g, preferably greater than 0.70 dl/g (a corresponding passage can be found on page 6, lines 13-17 of the application as originally filed). The amounts of 1-20 ppm titanium and 1-50 ppm phosphorus are disclosed in granted Claim 9 and Claim 9 as originally filed, respectively.

Although there is no explicit disclosure in the application as originally filed for an inherent viscosity of greater than 0.70 dl/g in combination with a catalyst system comprising 1-20 ppm titanium and 1-50 ppm phosphorus, it is conspicuous to the Board

that both the preferred range of the inherent viscosity and the preferred amounts of catalyst system are originally disclosed at the same level of generality. In other words, it is at least implicitly evident for the skilled reader that the preferred range for the inherent viscosity is associated with all the processes of the contested patent which produce the specified polyethylene terephthalate, including the processes using preferred amounts of catalyst system.

In connection with the withdrawn auxiliary request 3, the Appellant Opponent argued that the combination of an inherent viscosity of 0.70 dl/g with a catalyst system comprising 1-20 ppm titanium and 1-50 ppm phosphorus was not derivable from the application as originally filed (point XI(b), above), an argument which equally applies to the main request. However, for the reasons given above, the Board cannot follow this argumentation of the Appellant Opponent.

In view of the above, no objection under Article 123(2) EPC arises against amendments (2) and (3).

3.4 Since furthermore the amendments restrict the scope of granted Claim 1, no objections under Article 123(3) EPC arise.

4. *Novelty (main request)*

4.1 The only relevant document with respect to novelty is D11. D11 generally teaches the production of mouldable polyethylene terephthalate having an intrinsic viscosity ranging from 0.7 to 0.8 suitable for moulding bottles at a high moulding speed (paragraphs [0001]

and [0003]). More particularly, the polyethylene terephthalate is produced in a two-step reaction first by reacting dimethyl terephthalate and ethylene glycol in a transesterification reaction and then subjecting the resulting ester to polycondensation at a higher temperature.

4.1.1 The transesterification reaction is carried out in the presence of titanium tetraalkoxide treated with an organic carboxylic acid whereas the polycondensation reaction is carried out in the presence of a germanium compound together *inter alia* with orthophosphoric acid. Orthophosphoric acid is a synonym for phosphoric acid. However, the titanium catalyst used in the transesterification reaction is still present in the polycondensation reaction as can be seen from the examples in D11 where the germanium catalyst was added to the mixture resulting from the transesterification without there being any attempt to remove the titanium catalyst. Hence, the polycondensation reaction in D11 is carried out in the presence of a catalyst system comprising a titanium compound and phosphoric acid.

4.1.2 D11 uses intrinsic viscosity to further define the polyethylene terephthalate whereas Claim 1 of the main refers to an inherent viscosity. In this connection it should be pointed out that inherent viscosity varies with concentration while intrinsic viscosity is the hypothetical viscosity at a hypothetical "zero concentration". Thus, a different inherent viscosity is obtained at each concentration. If inherent viscosity is plotted on the y-axis and concentration on the x-axis, the y-intercept of the resulting graph is the intrinsic viscosity. Furthermore, it is apparent from

such a plot that the values for inherent viscosity are always below the value for intrinsic viscosity, but with lower concentrations the values for inherent viscosities approach the value of intrinsic viscosity.

As regards the measurement of the inherent viscosity in the patent in suit, it is conspicuous to the Board that paragraph [0022] of the patent specification indicates the solvent and the temperature for measuring the inherent viscosity but not the concentration.

Consequently, inherent viscosity could be measured at any concentration, for example at a very low concentration where the value for inherent viscosity approaches the value for intrinsic viscosity. This means that an inherent viscosity greater than 0.7 as required by Claim 1 of the main request is not a distinguishing feature over an intrinsic viscosity of 0.7 to 0.8 required in D11.

- 4.1.3 In Examples 1-3 of D11, titanium tetrabutoxide treated with acetic acid was used as the titanium catalyst in the transesterification reaction. Such a catalyst can be considered as an acyl titanium catalyst. Titanium tetrabutoxide, ie an alkyl titanate as required in Claim 1 of the main request, was used in Comparative Example 3 of D11. As pointed out by the Appellant Opponent, the data in Table 1 of D11 can be used to calculate the titanium and phosphorus content present in the examples of D11. These data show that all the examples, namely Examples 1-3 and Comparative Examples 1-4 have a titanium and phosphorus content falling within the range specified in Claim 1 the main request. In particular, Example 1 and Comparative

Example 3 contain about 7 ppm titanium and 20 ppm phosphorus.

- 4.2 It is evident from the above analysis of D11 that the process of Claim 1 of the main request is novel over the disclosure of D11. The process disclosed in Comparative Example 3 of D11 differs from the claimed process in that transesterification is carried out rather than direct esterification. The same applies to the process described in Examples 1-3 of D11. In addition, an acyl titanium catalyst is used in Examples 1-3 of D11 whereas Claim 1 of the main request requires an alkyl titanate. However, as regards this latter difference, these acyl titanium compounds used in the process of D11 do not seem to be so different from the titanium catalysts envisaged by the patent in suit. As can be seen from paragraph [0027] and Example 4 of the patent in suit, an acetyltriisopropyl titanate is considered to be an alkyl titanate according to Claim 1 although this compound contains an acyl group. Taking furthermore into account that the reaction between titanium tetraalkoxide and the organic carboxylic acid in D11 is not necessarily quantitative, it is difficult to acknowledge any difference in the titanium catalyst used in D11 and the titanium catalyst required in Claim 1 of the main request.

Nevertheless, due to the restriction to direct esterification alone, the subject-matter of Claim 1 of the main request and, by the same token, the subject-matter of Claims 2-25 (all claims directly or indirectly relating to a process requiring direct esterification) is novel over D11.

4.3 Claim 26 is directed to a the moulded article which is defined in terms of a process of manufacture ("A molded article prepared from moldable poly(ethylene terephthalate) made by the process of any one of Claims 1 to 20."). Such a claim is allowable if the product as such fulfils the requirements for patentability, ie *inter alia* that it is new.

4.3.1 The article claimed in Claim 26 is prepared via a direct esterification from (mainly) terephthalic acid and ethylene glycol whereas the bottles in D11 are prepared via a transesterification from dimethyl terephthalate and ethylene glycol. This difference in the starting compound manifests itself in the final product, namely the polyethylene terephthalate resin and the articles made therefrom, respectively. As explained by the Appellant Proprietor at the oral proceedings (point XI(d), above), transesterification as carried out in the process of D11 leads to a polyethylene terephthalate containing methyl ester end groups originating from the dimethyl terephthalate starting material. On the other hand, a polyethylene terephthalate obtained via direct esterification, as required in Claim 1 of the main request, would not contain such methyl ester end groups. These methyl ester end groups can be determined via NMR spectroscopy and can still be determined in a bottle made from the polyethylene terephthalate. Hence, the different starting material in the process of Claim 1 of the main request leads to a product that is different and distinguishable from the bottles obtained in the examples of D11, including Comparative Example 3. Therefore, the objection of the Appellant Opponent that the subject-matter of Claim 26 of the main request



- lacks novelty because it is undistinguishable from the bottle obtained in Comparative Example 3 of D11 must fail.
- 4.3.2 It follows from the above that also the subject-matter of Claim 26 and, by the same token, the subject-matter of dependent Claim 27, is novel over D11.
- 4.4 The disclosure of D3, and in particular Example 5 of D3, is not relevant to the subject-matter of the main request any more. Even one would assume, in favour of the Appellant Opponent, that the polyethylene terephthalate produced in Example 5 of D3 had an intrinsic viscosity of 0.65, such a value can never be equivalent to an inherent viscosity of greater than 0.7 dl/g (the values for inherent viscosity are always lower than the value for intrinsic viscosity and at most approach the value of intrinsic viscosity at very low concentrations (see point 4.1.2, above)).
- 4.5 In summary, the subject-matter of the main request is novel over the cited prior art, and in particular over D11.
5. *Problem and solution (main request)*
- 5.1 The patent in suit relates to a process for preparing modified or unmodified polyethylene terephthalate using a titanium/phosphorus catalyst system. As set out in paragraph [0020] of the patent specification, a number of advantages is associated with the claimed process: (1) the catalyst system contains low amounts of titanium and phosphorus and produces a polyethylene terephthalate of sufficient molecular weight to be

suitable in moulding applications, in particular for blow moulding bottles (paragraph [0070]), (2) the product has good clarity (less haze) and colour, (3) there is a low amount of metal and acetaldehyde in the final product and (4) a slow crystallization rate in the polyethylene terephthalate is obtained.

5.2 As set out in point 4.1, above, D11 relates likewise to a process for preparing polyethylene terephthalate useful for producing a moulded product, in particular for moulding bottles at a high moulding speed. The moulded products are excellent in transparency, mechanical strength and hue. In contrast to the process of Claim 1 of the main request, the polyethylene terephthalate of D11 is produced via a transesterification reaction whereby the catalyst system comprises *inter alia* a titanium and a phosphorus compound in amounts as required by Claim 1 of the main request. The organic titanium compound is produced in D11 by treating titanium tetraalkoxide with an organic carboxylic acid, eg acetic acid (Examples 1-4), so that the resulting titanium compound is considered to be an acyl compound. However, as explained in point 4.2, above, it is rather difficult to acknowledge any difference in the titanium catalyst used in D11 and the titanium catalyst required in Claim 1 of the main request.

5.2.1 It is apparent from the above, that D11 not only has most of the technical features in common with the claimed process, it also discloses technical effects and intended use most similar to the claimed process. Consequently, D11, and in particular the disclosure in

Examples 1-3 of D11, is regarded to represent the closest prior art.

- 5.2.2 The Appellant Opponent argued that rather D1 than D11 had to be considered as the closest prior art because the teaching of D1 was technically closer to the claimed subject-matter.

According to Claim 1, D1 provides a process for producing a polyester which comprises esterifying or transesterifying a carboxylic acid comprising mainly terephthalic acid or an ester-forming derivative thereof with a glycol comprising mainly ethylene glycol, and then polycondensing the reaction mixture thus obtained, the polycondensation being carried out in a reaction system having an organic titanium compound in an amount of from 10 to 100 ppm in terms of titanium atom to a theoretical yield of the polyester and a phosphorus compound in an amount of from 3 to 10 time mols in terms of phosphorus atoms to titanium atoms in the organic titanium compound. Like the patent in suit, the process of D1 envisages the preparation of polyethylene terephthalate which is explicitly intended for moulding applications and the production of hollow articles like containers [paragraph (0001) of D1]. The polyester obtained has a retarded crystallization rate and a satisfactory hue (paragraph [0003]). It is therefore accepted that D1 lies in precisely the same technical field as the patent in suit or D11.

Nevertheless, the Board cannot agree with the Appellant Proprietor that D11 is further away from the claimed subject-matter than D1. It requires at least four selections from the broad disclosure of D1 in order to

arrive at something falling within the scope of Claim 1 of the main request, namely the selection of direct esterification, selection of a certain amount of titanium, selection of certain amount of phosphorus and selection of certain type of phosphorus containing compound. On the other hand, D11 differs in at most two aspects, namely direct esterification and type of catalyst, if the latter is a real difference at all.

As regards the argument, that D11 is further away from the claimed subject-matter because the catalyst system of D11 contains in the polycondensation step a germanium compound, it has to be noted that Claim 1 of the main request does not exclude the presence of such a component. Indeed, Claim 1 is very broad in this respect and states only that "... said polycondensation is carried out in the presence of a catalyst system comprising from 1 to 20 parts of titanium present in the form of an alkyl titanate and from 1 to 50 parts of phosphorus in the form of a phosphate ester or phosphoric acid, ...". Thus, the broadness of the claims invalidates the argument of the Appellant Proprietor.

Taking furthermore into account that the technical effects described in D11 curiously line up with the advantages referred to in the patent in suit, selecting D11 as the closest prior art is entirely justified.

- 5.3 The next step in the "problem and solution approach" is an objective assessment of the technical results achieved by the claimed subject-matter, compared with the results according to the closest state of the art in order to define the objective technical problem.

First of all, the Board notes that a direct comparison between a process according to Claim 1 of the main request and a process according to D11 is not available. Nevertheless, it is apparent from Table 1 in D11 (Examples 1-3) that a low amount of titanium and phosphorus catalyst is used in the process of D11 to prepare the polyethylene terephthalate (which means that there is a low amount of metal in the final product) and that the bottles made from this resin have good haze properties and good colour index. Hence, most of the advantages referred to in the patent in suit are already achieved by the process of D11.

In this connection, the Appellant Proprietor pointed to the reduced acetaldehyde content in the final product which is mentioned in paragraph [0020] of the patent specification but not in D11. However, it has not been demonstrated that the claimed process indeed generates a lower level of acetaldehyde than the process of the closest prior art. Moreover, it is evident from the Experimental Report D12 submitted by the Appellant Proprietor that the amount of generated acetaldehyde increases with increasing amounts of titanium and phosphorus. Since D11 uses amounts of titanium and phosphorus within the claimed range, it is only logical to assume that the process of D11 produces equally low amounts of acetaldehyde. In view of the evidence on file one cannot plausibly argue that the claimed process achieves a lower level of acetaldehyde than the closest prior art. Hence, the alleged effect which is not supported by a comparison with the closest prior art cannot be taken into consideration in determining the problem underlying the invention and therefore in assessing inventive step (see Case Law of the Boards of

Appeal of the European Patent Office, 5<sup>th</sup> edition 2006, I.D.4.2).

In view of the above, the objective technical problem solved by the claimed subject-matter vis-à-vis the closest prior art as represented by Examples 1-3 of D11 has to be restated to meet a less ambitious objective, namely the provision of an alternative to the process disclosed in D11.

The Board is satisfied that this problem is solved by the features set out in Claim 1 of the main request.

6. *Inventive step (main request)*

6.1 Starting from D11 and trying to solve the posed problem, ie providing an alternative to the problem disclosed in D11, the question of inventive step is a two fold issue, namely (1) going from transesterification to direct esterification and (2) replacing an acyl titanate with an alkyl titanate.

6.1.1 As pointed out in paragraph [0002] of the patent in suit, it is well known that polyethylene terephthalate can be prepared either via direct esterification of ethylene glycol and terephthalic acid or via transesterification from dimethyl terephthalate and ethylene glycol. Both reaction types comprise two steps: (a) preparation of an intermediate and (b) condensation of the intermediate. The only difference between the two reaction types is that the respective intermediate is prepared from a different starting compound. The condensation step itself, which actually determines the molecular weight of the polyethylene terephthalate, is

identical in both cases. Thus, a person skilled in the art starting from D11 as the closest prior art and faced with the problem of providing an alternative to the process of D11 would immediately suggest the only other generally known reaction type for producing polyethylene terephthalate as the solution to this problem, namely direct esterification. Therefore, the restriction to direct esterification in Claim 1 of the main request is incapable of providing an inventive step.

6.1.2 Even if one would assume, in favour of the Appellant Proprietor, that there is a difference between the alkyl titanate required in Claim 1 of the main request and the acyl titanium catalyst used in D11 (which is, in view of the unclear distinction between alkyl titanates envisaged by Claim 1 of the main request and acyl titanates as used in D11 highly questionable (see point 4.2, above)), it is evident from D11 that replacing an acyl titanium catalyst by an alkyl titanate is a retrograde step. Table 1 of D11 shows that a catalyst system comprising acyl titanate and phosphorus yields better products (Examples 1-3) than a catalyst system comprising alkyl titanate and phosphorus (Comparative Example 3): The bottles prepared in Examples 1-3 have a much better colour index and better bottle haze properties than the bottle prepared in Comparative Example 3. It is clearly predictable from D11 that an alkyl titanate is an alternative, admittedly an inferior alternative, to the acyl titanate taught in D11. Thus, nothing inventive can be seen in reversing the teaching of D11 by reintroducing alkyl titanates.

- 6.1.3 It follows from the above, that the subject-matter of Claim 1 of the main request is not based on an inventive step.
- 6.2 The basic argument of the Appellant Proprietor with respect to inventive step was that D1 and not D11 was the closest prior art. Starting from D1, the subject-matter claimed in the main request was not rendered obvious by the prior art. However, the Board sees, as explained in point 5.2.2, above, no convincing argument which would discredit D11 as the closest prior art. At best, the Board is faced with the situation of two alternative starting points equally suitable for the assessment of inventive step, whereby one starting point, ie D11, leads to the conclusion that the claimed subject-matter is obvious and the other starting point, ie D1, gives exactly the opposite result. However, in this situation, D1 does not qualify as closest state of the art because it does not represent the most promising springboard towards the invention (see Case Law of the Boards of Appeal of the European Patent Office, 5<sup>th</sup> edition 2006, I.D.3.4). Therefore, the argumentation of the Appellant Proprietor with respect to inventive step must fail.
7. Claim 1 of the main request being not allowable, the main request had to be refused.



8. *Auxiliary request 8*

8.1 Amendments

Apart from the amounts of titanium and phosphorus, Claim 1 of auxiliary request 8 (point XI(f), above) differs from Claim 1 as granted in that

the polycondensation is carried out in the presence of a catalyst system consisting of ...,

optionally an inorganic toner consisting of salts of cobalt and

optionally an organic toner system comprising... .

Firstly, it is well recognised that the expression "**consisting of**" defines a so-called closed composition excluding the presence of further components. The application as originally filed discloses nowhere such a closed composition. Secondly, Claim 1 of auxiliary request 8 allows in the condensation step the further presence of an inorganic toner **and/or** an organic toner. The application as originally filed quite clearly discloses the presence of an inorganic toner **or** an organic toner. Thus, it is stated on page 9, lines 34-36 of the application as filed: "It is preferred in the process of this invention that the catalyst system further comprises an inorganic toner or an organic toner." Nor is there any claim in the application as originally filed which refers to the presence of an inorganic and an organic toner.

Consequently, Claim 1 of auxiliary request 8 does not meet the requirements of Article 123(2) EPC.

8.2 Claim 1 of auxiliary request 8 being not allowable, auxiliary request 8 has to be refused.

## **Order**

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

1. The decision under appeal is set aside.
2. The patent is revoked.

The Registrar:

The Chairman:

E. Görgmaier

R. Young