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# D E C I S I O N
## of 5 June 2003

**Case Number:** T 0038/02 - 3.2.5

**Application Number:** 91305427.6

**Publication Number:** 0465040

**IPC:** B29C 49/06

**Language of the proceedings:** EN

**Title of invention:**
Polyester polymer products

**Patentee:**
E.I. DUPONT DE NEMOURS AND COMPANY

**Opponent:**
Hoechst Trevira GMBH & KG
EASTMAN CHEMICAL COMPANY

**Headword:**
-

**Relevant legal provisions:**
EPC Art. 54, 56, 83

**Keyword:**
"Sufficiency of disclosure - yes"
"Novelty - yes"
"Inventive step - no"

**Decisions cited:**
-

**Catchword:**
-

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**Case Number:** T 0038/02 - 3.2.5

# DECISION
## of the Technical Board of Appeal 3.2.5
## of 5 June 2003

**Appellant I:** (Opponent 01)
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**Decision under appeal:**
**Decision of the Opposition Division of the European Patent Office posted 14 November 2001 rejecting the opposition filed against European patent No. 0465040 pursuant to Article 102(2) EPC.**

**Composition of the Board:**

**Chairman:** W. Moser
**Members:** H. M. Schram
W. R. Zellhuber

## Summary of Facts and Submissions

I. Appellants I and II (opponents 01 and 02) appealed from the decision of the Opposition Division rejecting their oppositions against European patent No. 0 465 040 as a whole based on Article 100(a) EPC (lack of novelty, cf. Article 54 EPC, and lack of inventive step, cf. Article 56 EPC) and Article 100(b) EPC (insufficiency of disclosure).

II. The following documents were in particular referred to in the appeal proceedings:

D1: US-A 4 340 721

D2: DE-A 2 062 283

D3: EP-A 0 247 566

D5: *Blow Moulding Handbook*, Rosato and Rosato (Eds.), Hanser Publishers, 1989, Chapter 14.

III. Oral Proceedings were held before the Board of Appeal on 5 June 2003.

At the end of the oral proceedings the requests of the parties were as follows:

Appellants I and II requested that the decision under appeal be set aside and that the patent in suit be revoked.

The respondent (patent proprietor) requested that the appeals be dismissed.

IV. Claim 1 of the patent in suit as granted reads as follows:

"1. An injection stretch blow moulded refillable pressure bottle made of a modified polyethylene terephthalate polymer which comprises:

i a threaded neck portion of transparent amorphous substantially non-oriented modified polyethylene terephthalate polymer;

ii a substantially cylindrical body portion of transparent biaxially oriented amorphous modified polyethylene terephthalate polymer having a thickness of from 0.4 to 0.9 mm and an area expansion ratio of at least 7; and

iii a base portion of transparent amorphous substantially non-oriented or partly oriented modified polyethylene terephthalate polymer;

in which the modified polyethylene terephthalate polymer is a randomly modified polyethylene terephthalate made by replacing from 1 to 6 mole % of the terephthalate units with units of a chain orientation disrupting aromatic dicarboxylic acid having an Intrinsic Viscosity of at least 0.75."

Independent claims 12 and 13 are directed to the use of the modified polyethylene terephthalate polymer as defined in claim 1 and to a method of making a refillable bottle as claimed in claim 1, respectively.

V. Appellants I and II argued essentially as follows:

In the Examples 1 to 5 given in the patent in suit preforms having a length from base to neck support of

152 mm and having an outside diameter of 31 mm were stretch blow moulded, forming bottles having a length from base to neck support of 315 mm and having an outside diameter of 83 mm. The preforms were first axially and then circumferentially stretched by a factor of 315/152 (≈ 2,07) and 83/31 (≈ 2,68) respectively, so that the area expansion ratio (2,07 • 2,68 ≈ 5,55) of the body portion of the bottle was *outside* the range ("of at least 7") claimed in claim 1. The respondent had stated during the opposition proceedings that the problem of keeping the levels of crystallinity in the base low "was solved by making the base of a substantially non-orientated or partially orientated polymer, and by ensuring that the polymer in the base region is rapidly cooled following moulding in order to discourage crystallisation" (see page 3, penultimate paragraph, of the letter filed on 8 October 1999). The claim and also the specification were however silent about such a cooling step. This lack of instruction placed an undue burden on the person skilled in the art to put the invention into practice.

The subject-matter of claim 1 was fully anticipated by the bottle disclosed in Example 3 of document D2, since the design of that bottle fell within the claimed ranges, and it was made of a PET polymer having an inherent viscosity of 0,91 and being modified in a manner that up to 10 mole% of the copolymer were monomer units of diethylene glycol and monomer units of an aromatic dicarboxylic acid (isophthalic acid).

Document D3 represented the closest prior art. This document disclosed an injection stretch blow moulded

refillable pressure bottle made of a PET polymer. The only difference between the subject-matter of claim 1 of the patent in suit and the known bottle was that the bottle according to the patent in suit was made of a *modified* PET polymer. Such modified PET polymers were known from document D1 to reduce the tendency of the PET to crystallize. The preforms used in document D3 were said to be prone to recrystallization as a result of the increased wall thickness, which led in turn to a decrease in transparency. The person skilled in the art thus had an incentive to modify the PET polymer used for making the bottle of document D3 in a manner taught by document D1, and would thus arrive at the invention in an obvious manner.

VI. The respondent argued essentially as follows:

The calculation of the axial stretch ratio by appellants I and II was flawed, since it was based on the premise that the shoulder, body portion, skirt and base of the preform were uniformly stretched, i.e. all by the same amount. This was clearly not the case, since shoulder and skirt were said to be less oriented than the body portion, see e.g. page 5, lines 17 to 20, and page 6, lines 5 to 8, of the patent in suit. Although it was perhaps beneficial that the *bottle* be cooled quickly after stretch blow moulding with a view to preventing recrystallization in the base, this was not essential for the performance of the invention. The invention merely required that care be taken to cool the *preform* quickly after injection moulding, see page 4, lines 52 to 59, of the patent in suit. Nothing else could be derived from the passage in the letter cited by appellants I and II. Crystallization of the

base region of the *bottle* was kept to a minimum by other means than *cooling* the bottle, *inter alia* by avoiding expansion in this region, see page 5, lines 4 to 7, of the patent in suit. The invention could thus be reproduced without any difficulty.

The subject-matter of claim 1 was novel with respect to document D2, since this document failed to disclose *inter alia* that the neck portion of the bottle was threaded.

With respect to the assessment of inventive step, the question to be answered was whether the skilled person had a motivation and/or a reasonable expectation of success to combine documents D3 and D1 in the manner suggested by appellants I and II. Of the nine copolymerizable modifiers for retarding crystallization disclosed in document D1, only one fell within the ambit of claim 1 of the patent in suit. The bottle known from document D1 was a single use bottle, not a bottle designed to be refilled. The problem addressed in document D1 was how to reduce the levels of acetaldehyde in the final article, and had nothing to do with refillability. In Example 1 of document D1 the amount of isophthalic acid was the same as in Example 4 of document D1, although the latter was a comparative example. The key argument of appellants I and II, viz. that document D3 pointed to the problem of haze in connection with recrystallization (see page 5, lines 29 to 32), was clearly misguided, since the decrease in transparency mentioned in said passage pertained to the *preform*, not to the *bottle*. Document D3 taught away from the invention, since the preferred polymer was a non-modified PET. The skilled person would not expect

any advantage of using a recrystallization retardant. The gist of the invention was that a particular PET polymer, namely a modified PET as defined in claim 1, and a particular process, namely injection stretch blow moulding, was used to produce a bottle having a particular design and properties, viz. a bottle having a reduced *orientation* in the base capable of surviving at least 20 refilling cycles. To sum up, the subject-matter of claim 1 was not obvious for a person skilled in the art having regard to the teachings of documents D1 and D3.

## Reasons for the Decision

1. *Sufficiency of disclosure*

Appellants I and II have contended that the preform having the dimensions specified in Example 1 of the patent in suit, was stretched by a factor of 5,55, whereas claim 1 required an area expansion ratio of at least 7. Assuming that the neck portion was 20 mm long, that the bottom portion was hemi-spherical and that the modified PET polymer had a density of 1,335 g/cm$^3$, appellants I and II calculated a wall thickness of 6,1 mm for the preform, so that the cylindrical body portion ("main wall") of the bottle would have a thickness of 6,1 mm/5,55 = 1,1 mm, a value which also was outside the range claimed in claim 1 (from 0,4 to 0,9 mm).

According to the established jurisprudence of the Boards of Appeal, sufficiency of disclosure must be assessed on the basis of the patent as a whole, i.e.

the description, the claims and, if any, the drawings. The disclosure must be reproducible without undue burden. The skilled person may use his common general knowledge to supplement the information contained in the patent. There is no requirement in the Convention that examples, or (preferred) embodiments of the invention, must necessarily be given.

In Example 1 the following is stated: *The preforms were 152 mm long (from base to neck support), had an outside diameter of 31 mm and weighed ca 108 g each. ... The reheated preforms were then stretch blow moulded to give bottles 315 mm high (from base to neck support and having an external diameter of 83 mm* (cf. page 7, lines 41 to 46, of the patent in suit).

The length *from base to neck support* is called the axial length and includes the base portion, cf. for example Figure 14.9 on page 552 of document D5. The calculation of appellants I and II is based on the assumption that the shoulder, body portion, skirt and base portion are axially stretched all by the same amount, since the preform is first stretched, then blow moulded. Even if axial stretching preceded circumferential stretching, this assumption would not be correct, since the base portion is only axially stretched by a negligible amount. If this effect is taken into account, the axial stretch of the body portion and, hence, the area expansion ratio in Example 1 will be *higher* than the values calculated by appellants I and II. It follows that, to say the least, their calculations may not be considered conclusive.

Even if, for the sake of argument, appellants I and II had demonstrated that the bottle disclosed in Example 1 had an area expansion ratio somewhat less than 7 and a wall thickness of somewhat more than 0.9 mm, this would not have meant that the invention is irreproducible. There is no technical difficulty to overcome in blow moulding a bottle having a wall thickness and an area expansion ratio within the ranges claimed in claim 1. The person skilled in the art would readily recognize that by reducing the external diameter and/or the wall thickness of the preform, or by increasing the external diameter of the bottle as specified in Example 1, a bottle is obtained falling within the ambit of claim 1.

It was no longer argued by appellants I and II that the expression "of transparent biaxially oriented amorphous modified polyethylene terephthalate polymer" in claim 1 was a contradiction in terms (amorphous and biaxially oriented rule out each other). In a communication annexed to the summons, the Board had pointed out that the skilled person, when considering a claim, would rule out interpretations which do not make technical sense. In said communication the Board further expressed its provisional opinion that the term "amorphous" in claim 1 meant that "*amorphous modified polyethylene terephthalate polymer*" (as starting material) was biaxially oriented (cf. process claim 13).

A second argument of appellants I and II was that it was essential for the performance of the invention that the base region of the bottle was rapidly cooled after moulding. Appellants I and II did however not file any evidence that a bottle that was not actively cooled

after moulding, but otherwise produced in accordance with Example 1, did not solve the problem of the invention, viz. that such a bottle did not meet the requirements of refillability.

It is well-known in the art that stretch blow moulding is a balancing act: the preform must be heated above the glass temperature, but it should not become too hot, because otherwise no orientation will result. A typical temperature range for stretch blow moulding PET bottles is around 100 °C, which is above the minimum temperature for crystallization on heating ($T_{ch}$) where crystallization will develop, albeit slowly. The person skilled in the art, being aware that processing time should be kept to a minimum (see e.g. document D5, paragraph bridging pages 547 and 548) in order to minimize crystallization, will therefore keep the finished bottle not longer than necessary above $T_{ch}$.

In the judgement of the Board, the step of cooling the bottle after moulding is thus an optional step, not a necessary step. Since it is common general knowledge that, depending on the circumstances, cooling the bottle may *further* reduce crystallization in the base of the bottle, the fact that this has not been mentioned in the description or in claim 1 of the patent in suit cannot be objected to under Article 83 EPC.

For the above reasons, the Board is satisfied that the patent in suit discloses the invention in a manner sufficiently clear and complete to be carried out by a person skilled in the art (cf. Articles 100(b) and 83 EPC).

2. *Novelty*

Appellants I and II have submitted that claim 1 lacked novelty with respect to document D2. However, document D2 does not disclose, directly and unambiguously, the feature of claim 1 that the neck portion is threaded.

None of the other cited documents disclose an injection stretch blow moulded refillable pressure bottle made of a modified PET polymer with all the features of claim 1. Since this was not disputed, there is no need for further substantiation of this matter.

The subject-matter of claim 1 is therefore novel within the meaning of Article 54 EPC.

3. *Inventive step*

The present invention seeks to solve the problems associated with a practically satisfactory refillable PET bottle (cf. page 2, lines 32 to 34, of the patent in suit). A refillable bottle must be capable of surviving a minimum of 20 and preferably more refilling cycles (cf. page 2, lines 15 to 16, of the patent in suit), which include filling the bottle under pressure, emptying, washing and refilling the bottle. The bottle must not change its size or shape during use. Creep of the material of the bottle whilst under pressure and stress cracking promoted by the washing process must be minimized. The aforementioned requirements ("problems") are met ("solved") by the bottle according to claim 1. In particular, by using a particular type of modified PET polymer in combination with the injection stretch

blow moulding technique of bottle forming and by giving the bottle a particular design (cf. features (i) through (iii) in claim 1), the bottle is capable of surviving a minimum of 20 refilling cycles. The proportion of units of the chain orientation disrupting aromatic dicarboxylic acid used is sufficient to reduce the tendency of the PET to crystallize but not so great as to reduce the strength of the PET as to make the bottles susceptible to creep in use (cf. page 3, lines 39 to 41, of the patent in suit).

Document D3 represents the closest prior art. This document relates to a refillable bottle. The problems of crack propagation and creep are identified on page 4, line 1, to page 5, line 47, and page 6, lines 1 to 4. The only difference between the subject-matter of claim 1 of the patent in suit and the bottle known from this document is that the bottle according to the patent in suit is made of a modified PET polymer as specified in claim 1.

Document D3 teaches to use preforms having an increased *wall thickness*. The extent of creep of the finished bottle will increase with decreasing wall thickness, cf. page 5, lines 46 to 47. A disadvantage of using preforms having an increased *wall thickness* over that of previous preforms is a partial molecular recrystallization of the preform in the cavity, *resulting in a decrease in transparency (i.e. haze) in these preforms,* cf. page 5, lines 30 to 33.

The person skilled in the art is thus informed that recrystallization of the preform is detrimental to its clarity. The respondent has argued that the skilled

person would not consider transparency in the preform as a problem, since it was transparency of the bottle that mattered. However, it is known that the clarity of the preform and the clarity of the resulting bottle are related, see e.g. document D5, page 548 (*Processing PET Preforms*), third paragraph, wherein it is stated: "*When starting with a preform of good clarity, the optimum container will be equally free of pearlescence (stress whitening) and crystallization haze.*"

In looking for a solution to the problem of reducing crystallization of the preform in the cavity, the attention of the skilled person will be drawn to document D1. This document teaches that using a copolymerizable modifier such as carboxylic acid in an amount between 1,5 and 7,5 mol%, in particular isophthalic acid, is beneficial for ***retarding crystallization***, see column 3, line 47 to column 4, line 8, and Examples 1 and 2. This document further teaches that such modified PET *can be molded by any process to form containers/packages/bottles* such as for example injection moulding or blow moulding, see column 4, lines 51 to 58. Reduced rates of recrystallization make it possible to produce preforms having thick walls, see column 4, lines 59 to 62. The amount of the modifier falls to a large extent within the specification of the modified PET polymer given in claim 1.

The respondent has submitted that the skilled person would not combine document D3 and document D1, because the latter did not relate to a refillable bottle. Moreover, the problem to be solved in document D1 was to reduce the levels of acetaldehyde of an article, not

to improve the refillability thereof. Isophthalic acid was used in comparative Example 4 in the same amount as in Example 1 of the invention according to document D1, so that the skilled person would not attach any significance to its use. In contrast to document D1, the patent in suit was not about reducing the crystallinity of the preform, but about reducing the orientation of the base portion of the bottle.

These arguments cannot convince the Board. It is correct that the objective of document D1 is primarily to reduce the amounts of acetaldehyde in molded shaped articles. However, one of the underpinnings of the invention of document D1 is that these amounts are *inter alia* related to the recrystallization characteristics of the polymer during the quenching operation in the molten state, i.e. during the production of the preform, cf. column 2, lines 37 to 51. The Examples and comparative Examples of document D1 show that high levels of isophthalic acid give rise to a high value for the thickness e, which is a measure for the rate of recrystallization, cf. column 5, lines 34 to 38. The Examples merely confirm that isophthalic acid slows down the rate of recrystallization. Under the heading "2. Description of the Prior Art" a slow rate of crystallization in a preform having thick walls is recommended to improve the transparency of the final article, cf. column 1, lines 29 to 41. This corresponds exactly to the disadvantage of preforms having an increased wall thickness mentioned on page 5, lines 30 to 33, of document D3. The person skilled in the art thus had good reasons to consult document D1 with a view to solving the problem posed, i.e. to reduce the crystallization in the preform. It is noted in this

respect that the patent in suit also recommends to avoid or at least minimise any crystallization in the preform, cf. page 5, lines 3 to 6.

It follows from the above analysis that the skilled person, starting from document D3 and looking for a solution to the problem of avoiding or minimizing haze in a preform with an increased wall thickness, would turn to document D1 and find the solution for that problem, i.e. to modify the PET polymer as described in document D1.

The subject-matter of claim 1 thus lacks an inventive step within the meaning of Article 56 EPC.
Consequently, the sole request of the respondent is not allowable.

## 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:

M. Dainese W. Moser