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D E C I S I O N
of 11 March 2004

Case Number: T 0862/01 - 3.3.3

Application Number: 96112949.1

Publication Number: 0759446

IPC: C08F 214/26

Language of the proceedings: EN

Title of invention:
Tetrafluorethylene terpolymer

Patentee:
E.I. DU PONT DE NEMOURS AND COMPANY

Opponent:
AUSIMONT S.p.A.

Headword:
-

Relevant legal provisions:
EPC Art. 56, 114(2)

Keyword:
"Inventive step (yes)"

Decisions cited:
T 0534/98, T 0051/00

Catchword:
-



Case Number: T 0862/01 - 3.3.3

D E C I S I O N
of the Technical Board of Appeal 3.3.3
of 11 March 2004

Appellant:
(Opponent)

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Respondent:
(Proprietor of the patent)

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Decision under appeal:

Decision of the Opposition Division of the
European Patent Office dated 8 May 2001 and
posted 5 June 2001 rejecting the opposition
filed against European patent No. 0759446
pursuant to Article 102(2) EPC.

Composition of the Board:

Chairman: R. Young
Members: C. Idez
H. Preglau

Summary of Facts and Submissions

- I. The grant of the European patent No. 0 759 446 in the name of E.I. Du Pont de Nemours and Company in respect of European patent application No. 96 112 949.1 filed on 12 August 1996 and claiming the priorities of US 2403 (17 August 1995) and US 606132 (23 February 1996) was announced on 13 January 1999 (Bulletin 1999/02) on the basis of 5 claims.

Independent Claim 1 read as follows:

"A partially-crystalline copolymer comprising tetrafluoroethylene, hexafluoropropylene in an amount corresponding to HFPI of from 2.8 to 5.3, and from 0.2% to 3% by weight of perfluoro(ethyl vinyl ether)."

Claims 2 to 5 were dependent claims.

- II. A Notice of Opposition was filed against the patent by Ausimont S.p.A on 8 October 1999. The Opponent requested complete revocation of the patent based on Article 100(a) EPC, on the ground that the subject-matter of Claims 1 to 5 lacked inventive step.

This objection was supported *inter alia* by the following documents:

D1: US-H-130; and

D3: US-A-4 029 868.

III. By a decision announced orally on 8 May 2001 and issued in writing on 5 June 2001, the Opposition Division rejected the opposition.

IV. According to the decision, D1 was considered as the closest state of the art. Starting from D1, the technical problem was seen in the provision of tetrafluoroethylene (TFE)/hexafluoropropylene (HFP) copolymers allowing a faster extrusion rate, while maintaining a good stress crack resistance (SCR). According to the decision the only difference between D1 and Claim 1 of the patent in suit was that the terpolymers of D1 contained perfluoro propyl vinyl ether (PPVE) as third comonomer instead of perfluoro ethyl vinyl ether (PEVE).

The decision stated that D3 which related to terpolymers of TFE/HFP/PEVE and TFE/HFP/PPVE having a hexafluoropropylene index (HFPI) of 0.9 to 2.7, did not suggest that PEVE was the preferred comonomer, let alone that it would provide an improvement of the extrusion rate.

Furthermore the Opposition Division took the view that it would not have been possible to conclude from Example 13 of D3, which related to a terpolymer comprising PEVE having a low melt viscosity and a high MIT flex life (i.e. a high SCR) that PEVE in general would lead to terpolymers having a better extrusion rate and better MIT values than those comprising PPVE. The Opposition Division further held that the Opponent's interpretation of the data of D1 and D3 appeared to be based on an *ex post facto* analysis. It thus concluded that D3 did not suggest the replacement of PPVE by PEVE in the terpolymers of D1 in order to solve the technical problem.

V. A Notice of Appeal was filed on 27 July 2001 by the Appellant (Opponent) with simultaneous payment of the prescribed fee. With the Statement of Grounds of Appeal, filed on 2 October 2001, the Appellant submitted the following documents:

A4: "Teflon®-Tefzel®" Extrusion Guide for Melt Processible Fluoropolymers;

A5: Kirk-Othmer "Encyclopedia of Chemical Technology", 4th Ed., 1994, John Wiley & Sons, Vol. 11, pages 644 to 656;

A6: Z. Tadmor et al "Principles of Polymer Processing", 1979, John Wiley & Sons; pages 539 to 542, 560 to 563, 567, and Table 13.1;

A7: "Ullmann's Encyclopedia of Industrial Chemistry"; Fifth Completely Revised Edition, 1988, VCH Verlagsgesellschaft, Vol. A-11, pages 402 to 405; and

A8: "Teflon®-Tefzel® fluoropolymer resin"; Product Information, page 7.

It also argued essentially as follows:

- (i) D1 taught that the extrusion rate of TFE/HFP copolymers could be increased by lowering their melt viscosity.

- (ii) D3 related to copolymers having melt viscosities low enough to be used in conventional processing techniques.
- (iii) It was common general knowledge (cf. A4 to A8) that the conventional processing techniques included extrusion.
- (iv) It was therefore clear that the copolymers of D3 were used for extrusion.
- (v) The polymers of D3 showed low melt viscosity and good flex life (i.e. a good SCR).
- (vi) The conclusion of the Opposition Division that it could not have been expected that the results of D3 would also be obtained for copolymers having a higher HFP content, was not correct, since D1 taught to increase the HFP content in order to improve the extrusion rate.
- (vii) It could further be seen from D3 that PEVE was indeed the preferred comonomer. From the comparison of Example 13 of D3 with Example 2 of D3 and Comparative Example B of D1, it was clear that the copolymer with PEVE (Example 13) could be extruded at a faster extrusion rate.
- (viii) Thus, by applying the teaching of D1 to the copolymers of D3, the skilled person would therefore have expected a faster extrusion rate.
- (ix) D1 further showed that by increasing the HFP content the MIT flex life was improved.

- (x) The same trend was observed in D3 (cf. Examples 6 and 8 of D3).
- (xi) Furthermore, the comparison between Example 11 and Example 13 of D3 showed that the terpolymer with PEVE had a better flex life, although its HFP content was lower. Thus, the skilled person would have known that by increasing the amount of HFP in the terpolymer with PEVE the flex life would be further improved.
- (xii) Thus, the combination of D3 with D1 suggested the use of PEVE as comonomer for solving the technical problem.

VI. With its letter dated 20 June 2002, the Respondent submitted three further documents. It also argued essentially as follows:

- (i) The relevance of the documents A4 to A8 submitted by the Appellant was not clear. They should not be admitted into the proceedings.
- (ii) The arguments of the Appellant were based on data points, i.e. Examples of D1 and D3, which formed only a very minor part of the total data of these documents. There was only one example in D3 concerning PEVE.
- (iii) The conclusion drawn by the Appellant was opposite to that which the skilled person would have drawn from the generic disclosure of these documents.

- (iv) D1 represented the closest state of the art. The technical problem was to improve the performance of the copolymers of D1.
- (v) In that respect, it would appear that the Appellant had considered D3 as the closest state of the art.
- (vi) The simplistic view of the Appellant that lowering the melt viscosity of TFE/HFP copolymers would allow a faster extrusion rate while keeping stress crack resistance at a high level was refuted by the Examples 8 to 10 of the patent in suit. They showed that PEVE terpolymers performed unexpectedly better than PPVE terpolymers of similar melt viscosity.
- (vii) The extrusion rate depended on the resistance to high shear and on the melt drawability of the terpolymers.
- (viii) The extrusion rate could not be improved simply by lowering the melt viscosity.
- (ix) There was no suggestion in D1 that for a given melt viscosity the extrusion rate would be faster for a PEVE terpolymer than for a PPVE terpolymer.
- (x) D3 was totally silent on the extrusion rate of the copolymers disclosed therein.
- (xi) The Appellant had argued in view of the comparison of Example 2 of D3 and Comparative

Example B of D1 that by increasing the HFP amount the flex life and the extrusion rate would be increased. If, however, one would compare Example 2 and 11 of D3 one would come to the opposite conclusion, namely, that the flex resistance decreased when the HFP content increased. Consequently, the conclusions which the Appellant had attempted to draw from its comparison of Example 2 and Comparative Example B were meaningless.

VII. In its letter dated 10 February 2004, the Appellant further argued essentially as follows:

- (i) The problem to be solved by the patent in suit was to provide TFE/HFP copolymers having a faster extrusion rate and a high SCR with respect to TFE/HFP/PPVE copolymers of D1.
- (ii) The aim of D1 in respect of D3 was, in particular to allow a faster extrusion rates while keeping a high SCR.
- (iii) The comparison between Example 13 of D3 and Comparison Example B of D1 showed that the SCR was higher with the PEVE copolymer although its melt viscosity was lower.
- (iv) Thus, the opposed patent lacked inventive step, since D1 taught the skilled person that, by increasing the HFP content in TFE/HFP/PPVE it was possible to obtain a faster extrusion rate at some sacrifice of the SCR. There was a clear teaching in D1 how to improve the extrusion rates

of TFE/HFP copolymers (cf. column 1, lines 27 to 30). This teaching was not restricted to TFE/HFP/PPVE terpolymers.

- (v) Since the SCR was higher for PEVE copolymers, the skilled person would have expected a faster extrusion rate with some sacrifice of the SCR.
- (vi) Furthermore, there was no prejudice in the art against increasing the amount of HFP in TFE/HFP/perfluoro alkyl vinyl ether copolymer. This was shown by D3.

VIII. Oral proceedings were held on 11 March 2004.

At the oral proceedings, the discussion was essentially concentrated on issues concerning (i) the admission into the proceedings of documents A4 to A8 submitted by the Appellant with the Statement of Grounds of Appeal in order to show that extrusion belonged to the melt processing methods of thermoplastics and (ii) the assessment of inventive step of the subject-matter of the patent in suit.

Concerning point (i) both parties agreed that extrusion belonged to the melt processing methods of thermoplastics and that therefore the copolymers disclosed in D3 could be used in extrusion.

Concerning point (ii), while essentially relying on their previous submissions made in the written procedure, the following further submissions were made by the Parties:

- (ii.1.) The submissions of the Appellant could be summarized as follows:
 - (ii.1.1) The aim of the patent in suit was to provide TFE/HFP copolymers which could be extruded faster without sacrifice of SCR.
 - (ii.1.2) Although document D1 apparently presented alternative technical problems to be solved by the TFE/HFP/PPVE terpolymers disclosed therein, i.e. either increasing the extrusion rate while keeping the SCR at a high level or increasing the SCR while maintaining the same melt viscosity, these problems were indeed related.
 - (ii.1.3) The SCR was closely related to the melt viscosity, i.e. the higher the melt viscosity, the higher the SCR.
 - (ii.1.4) The extrusion rate was dependent on the melt viscosity. This could be derived from the relation according to which the product of the melt viscosity and the shear rate was a constant (i.e. $\eta \cdot \dot{\gamma} = \text{constant}$ where η is the melt viscosity and $\dot{\gamma}$ the shear rate). This relation implied that by reducing the melt viscosity one would inevitably increase the shear rate, and one would therefore obtain a higher speed of extrusion.
 - (ii.1.5) From D1 it was further known that it was possible to increase the SCR of TFE/HFP copolymers by using a third fluoro ether

comonomer. Thus, it would be possible to sacrifice a part of this increase of SCR and to allow a reduction of the melt viscosity of the copolymer and thus to obtain a higher extrusion rate while still maintaining a high SCR.

(ii.1.6) Furthermore, the comparison between the (TFE/HFP/PEVE terpolymer of Example 13 with the TFE/HFP/PPVE terpolymers of Examples 12 and 2 of D3, (all having been prepared under the same conditions) showed that the use of PEVE as third comonomer led to copolymers having a higher SCR and lower melt viscosity and thus a higher extrusion rate than those using PPVE as third comonomer. Thus it was obvious to obtain a copolymer having a higher extrusion rate than those of D1 while maintaining a high SCR by using PEVE instead of PPVE.

(ii.1.7) The comparison between Example 3 and 6 of the patent in suit relied on by the Respondent for demonstrating that minor compositional variations led to major property variations, and that therefore no valid conclusion could be drawn from the comparison between Example 13 with Examples 12 and 2, was not pertinent since the conditions of manufacture of the copolymers of these examples of the patent in suit were different. On the contrary, the copolymers of Examples 2, 12 and 13 of D3

had been obtained under the same process conditions.

- (ii.1.8) Examples 8 to 10 of the patent in suit were silent on the SCR properties of the copolymers. Thus, it was not clear as to whether the technical problem had been solved.

- (ii.2.) The Respondent argued essentially as follows:
 - (ii.2.1) The problem underlying the patent in suit with respect to D1 taken as the closest state of the art was to develop copolymers having a higher extrusion at the same melt viscosity, i.e. the improvement of the extrusion rate was not made at the cost of the SCR.

 - (ii.2.2) Examples 8 to 10 of the patent in suit showed that at comparable melt viscosities the copolymers of the patent in suit could be extruded at a higher extrusion rate than those containing PPVE as third comonomer. These examples thus showed that the copolymers according to the patent in suit had a better melt strength (resistance to melt fracture).

 - (ii.2.3) Document D3 was not concerned with the problem of increasing the extrusion rate. It was further not possible to draw valid conclusions from the comparison of Examples 12 and 13, since the examples

differed not only in the choice of third comonomer, but also in the amounts of HFP and of the third comonomer. In view of the melting points indicated for the copolymers in table IV of D3 (i.e. relating to Examples 12 and 13) it was further doubtful as to whether these examples were correct, since one would have expected much lower melting points.

IX. The Appellant requested that the decision of the Opposition Division be set aside and the patent be revoked.

The Respondent requested that the appeal be dismissed.

Reasons for the Decision

1. The appeal is admissible.
2. *Procedural matters*
 - 2.1 The Board has been confronted, on the one hand, with the filing of documents A4 to A8 by the Appellant with the Statement of Grounds of Appeal, and on the other hand, with the submission by the Respondent with its letter dated 20 June 2002 of three further documents.
 - 2.2 Documents A4 to A8 had been submitted by the Appellant in order to show that extrusion belongs to the melt processing methods of thermoplastics and that therefore the copolymers disclosed in D3 and presented as melt-fabricable which could be processed in ordinary

apparatus used in shaping and moulding thermoplastic polymers (cf. D3, column 3, lines 40 to 42) could be used in an extrusion process. Since these points were not disputed (cf. point VIII (i) above), there was no need, in the Board's view, to submit documents establishing this part of common general knowledge (cf. also T 534/98 of 1 July 1999, Reasons point 8, not published in OJ EPO).

2.3 Consequently, documents A4 to A8 were not admitted into the proceedings (Article 114(2) EPC).

2.4 Concerning the documents submitted by the Respondent with its letter dated 20 June 2002, neither the Respondent nor the Appellant referred to them during the oral proceedings held on 11 March 2004 and the Board saw no need to consider them in the present decision. Thus, it was not necessary to decide on their admissibility into the proceedings.

3. *The patent in suit, the technical problem*

3.1 The patent in suit is concerned with TFE/HFP copolymers which can be extruded at a high extrusion rate without sacrifice of SCR (cf. page 2, line 33). Such copolymers are known from document D1, which the Board, in common with the Parties and the Opposition Division, regards as the closest state of the art.

3.2 Document D1 relates to terpolymers of TFE, HFP and PPVE, comprising 9 to 17 percent (i.e. having an HFPI index of 2.8 to 5.3, when using a conversion factor of 3.2) and 0.2 to 3 weight percent of PPVE (cf. Claim 1; column 3, lines 12 to 25). Consequently, the

terpolymers of D1 are distinguished from the terpolymers according to the patent in suit only in that PPVE is used as third comonomer instead of PEVE. As further indicated in D1, these terpolymers allow fast extrusion rates while keeping the SCR at a high level (column 1, lines 40 to 44).

- 3.3 Thus, starting from D1, the technical problem underlying the patent in suit might be seen in the provision of terpolymers allowing a faster extrusion rate without sacrifice of SCR (cf. patent in suit page 2, lines 33, 47 to 50).
- 3.4 The solution proposed according to Claim 1 of the patent in suit is to use PEVE as third comonomer instead of PPVE.
- 3.5 In that respect, Examples 8, 9, 10 and Control B clearly show that the terpolymers according to the patent in suit can be extruded faster than those according to D1 containing PPVE. While it is true, as submitted by the Appellant, that these examples did not expressly mention the SCR of the terpolymers according to the patent in suit, the Board observes that these terpolymers exhibit a melt viscosity very similar to that of the terpolymers according to D1 used as comparison basis, so that it is highly probable that the increase of the extrusion rate has not been achieved at the cost of the SCR, since, as admitted by the Appellant (cf. point VIII (ii.1.3) above), melt viscosity and SCR are closely related. In any case, no relevant experimental evidence of a degradation of the SCR has been submitted by the Appellant, on whom the

onus of proof lay (cf. T 51/00 of 26 March 2003, Reasons 3.7, not published in OJ EPO).

3.6 Thus, the Board is satisfied that the technical problem is effectively solved by the claimed measures.

4. *Inventive step*

4.1 It remains to be decided whether the solution of the technical problem was obvious to a person skilled in the art having regard to the prior art relied upon by the Appellant.

4.2 Document D1 which teaches to reduce the melt viscosity in order to increase the extrusion rate (cf. column 1, lines 27 to 30, 40 to 44) concedes, however, that lowering the melt viscosity inevitably results in a sacrifice of the SCR (column 1, lines 30 to 34).

4.3 Consequently, D1 itself, which is further totally silent on the incorporation of PEVE as comonomer in TFE/HFP copolymers, cannot provide any assistance to the solution of the technical problem, the essence of which is precisely not to accept a sacrifice of the SCR or, consequently, a reduction of the melt viscosity.

4.4 Document D3 relates to fluorinated terpolymers, and more particularly to terpolymers of TFE, HFP and either PPVE or PEVE. These terpolymers contain, in randomly polymerized form, units of TFE, units of HFP in an amount of between 4 and 12 weight percent based on weight of terpolymer, and units of PEVE or PPVE in an amount of between 0.5 and 3 weight percent based on weight of terpolymer (cf. column 2, lines 24 to 33). In

its Example 13, D3 discloses a terpolymer comprising units of TFE, 4.5 wt% HFP and 1.2 wt% PEVE. The terpolymers have a melt viscosity low enough to be processed in ordinary apparatus used in shaping and moulding thermoplastic polymers. They exhibit a high temperature tensile strength superior to that of TFE/HFP copolymers and a flex life (i.e. SCR) approaching or surpassing that of TFE/HFP copolymers (column 2, lines 15 to 19; column 3, lines 40 to 42). The terpolymers are useful in particular as electrical insulation wire column 4, lines 7 to 10).

- 4.5 While there can be no doubt as to whether the terpolymers of D3 can be processed by extrusion, it is however evident that is no explicit disclosure in D3 concerning the respective extrusion rates of the TFE/HFP/PEVE and TFE/HFP/PPVE terpolymers disclosed therein.
- 4.6 Nor could such an indication be implicitly derived from the comparison between Example 13 with Examples 12 and 2 of D3, contrary to the submissions of the Appellant (cf. point VIII (ii.1.6), above), for the following reasons:
- 4.6.1 It is firstly highly questionable, in view of the different amounts of HFP and of third comonomer (i.e. PEVE in Example 13 and PPVE in Examples 2 and 12) in each terpolymer disclosed in these examples, as to whether it can be concluded from this comparison, except on the basis of an *ex post facto analysis*, that the low melt viscosity and the high SCR of the terpolymer of Example 13 is due only to the presence of PEVE as third comonomer instead of PPVE, let alone that

this effect could be generalized to any terpolymer comprising PEVE as third comonomer.

4.6.2 Furthermore, even if one would have reached the conclusion that, for obtaining the same SCR as for the TFE/HFP/PPVE terpolymer, the melt viscosity of the TFE/HFP/PEVE copolymer might be lowered, this would not imply that the extrusion rate which can be achieved by the TFE/HFP/PEVE terpolymer would inevitably be higher, because the practicable extrusion rate is any case limited by the resistance to the melt fracture of the copolymer at high shear rate, i.e. by its critical shear rate (as shown by Examples 8 to 10 of the patent in suit) on which D3 is totally silent.

4.7 Consequently, document D3 is, in the Board's view, neither explicitly nor implicitly concerned with the respective extrusion rates of the terpolymers disclosed therein (cf. Sections 4.5 and 4.6 above). It is, however, evident from the foregoing that the crucial issue in relation to the objective technical problem (cf. Section 3.3 above) is whether or not there can be an expectation of increased extrusion rates. Consequently, the absence from D3 of any teaching directly or indirectly concerning such rates means that the disclosure of D3 can have no relevance for the assessment of inventive step of the claimed subject-matter. For this reason also, the numerous submissions made by the Appellant, in particular at the oral proceedings, concerning D3, all of which concerned subordinate relationships within the disclosure of that document could not alter the fundamental deficiency of its disclosure, that it could not add anything to the

disclosure of D1 in relation to the relevant issue of extrusion rates.

4.8 Thus, it follows from the above that the solution of the technical problem does not arise in an obvious way from the state of the art relied upon by the Appellant.

4.9 Consequently, the subject-matter of Claim 1, and by the same token that of dependent Claims 2 to 5 involves an inventive step (Article 56 EPC).

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:

E. Görgmaier

R. Young