

Internal distribution code:

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

**Datasheet for the decision
of 4 May 2022**

Case Number: T 0058/19 - 3.3.03

Application Number: 12797911.0

Publication Number: 2791191

IPC: C08F214/18, C08F214/22,
C08K5/00

Language of the proceedings: EN

Title of invention:

CROSSLINKABLE VINYLIDENE FLUORIDE AND TRIFLUOROETHYLENE
POLYMERS

Patent Proprietor:

Solvay Specialty Polymers Italy S.p.A.

Opponent:

ARKEMA France

Relevant legal provisions:

RPBA Art. 12(4)
RPBA 2020 Art. 13(1), 13(2)
EPC Art. 56

Keyword:

Evidence submitted with the statement of ground (not admitted)
- evidence submitted with the rejoinder (admitted)
Inventive step (yes) - objection based on an ex post facto
analysis



Beschwerdekammern

Boards of Appeal

Chambres de recours

Boards of Appeal of the
European Patent Office
Richard-Reitzner-Allee 8
85540 Haar
GERMANY
Tel. +49 (0)89 2399-0
Fax +49 (0)89 2399-4465

Case Number: T 0058/19 - 3.3.03

D E C I S I O N
of Technical Board of Appeal 3.3.03
of 4 May 2022

Appellant:

(Opponent)

ARKEMA France
420 Rue d'Estienne d'Orves
92700 Colombes (FR)

Representative:

Bandpay & Greuter
30, rue Notre-Dame des Victoires
75002 Paris (FR)

Respondent:

(Patent Proprietor)

Solvay Specialty Polymers Italy S.p.A.
Viale Lombardia, 20
20021 Bollate (MI) (IT)

Representative:

Benvenuti, Federica
Solvay S.A.
Département de la Propriété Intellectuelle
Rue de Ransbeek, 310
1120 Bruxelles (BE)

Decision under appeal:

**Decision of the Opposition Division of the
European Patent Office posted on 7 November 2018
rejecting the opposition filed against European
patent No. 2791191 pursuant to Article 101(2)
EPC.**

Composition of the Board:

Chairman

D. Semino

Members:

F. Rousseau

R. Cramer

Summary of Facts and Submissions

- I. The appeal lies against the decision rejecting the opposition against European patent No. 2 791 191 whose claim 1 reads as follows:

"1. A semi-crystalline fluoropolymer [polymer (F)] comprising:

- recurring units derived from vinylidene fluoride (VDF);
- from 10% to 50% by moles [with respect to the total moles of recurring units of polymer (F)] of recurring units derived from trifluoroethylene (TrFE); and
- from 0.01% to 10% by moles [with respect to the total moles of recurring units of polymer (F)] of recurring units derived from at least one monomer comprising an azide group [monomer (Az)]."

The additional claims concern semi-crystalline fluoropolymers within the ambit of claim 1 (dependent claims 2 to 9), a process for the manufacture of these semi-crystalline fluoropolymer according to anyone of claims 1 to 9 (claim 10), crosslinkable compositions comprising these semi-crystalline fluoropolymers (claims 11 and 12), a method of crosslinking these semi-crystalline fluoropolymers or crosslinkable compositions comprising these semi-crystalline fluoropolymers (claim 13) and a method for manufacturing one of electrical and electronic devices, comprising using these semi-crystalline fluoropolymers (claims 14 and 15).

- II. The opposition proceedings were based among others on the following items of evidence:

D1: US 2002/0049343 A1

D2: US 2007/0166838 A1

D3: WO 2009/147030 A1

D4: WO 2005/064705 A1

III. According to the reasons for the contested decision which are pertinent for the appeal proceedings:

- (a) D2 represented the closest prior art, whereas D1 and D3 were more remote.
- (b) The subject-matter of granted claim 1 differed from that of D2 in that the fluoropolymer comprised from 0.01 to 10 mol% of an azide group containing monomer.
- (c) Having regard to the experimental results contained in the specification, the objective problem solved over the closest prior art resided in the provision of a VDF/TrFE copolymer showing inherent crosslinking ability and higher effectiveness in crosslinking in combination with a crosslinking agent of the bis-azide type, while maintaining ferroelectric properties.
- (d) The available prior art would not have prompted the skilled person to introduce an azide group containing monomer into the fluoropolymer of the closest prior art in order to solve this problem.
- (e) Accordingly, the sole ground of opposition invoked against the patent as granted failed to convince.

IV. An appeal against that decision was lodged by the opponent (appellant). With a letter filed on the same

day as the statement of grounds of appeal the appellant submitted the following documents:

D9: US 4,778,867

D10: US 4,784,915.

- V. In response to the statement of grounds of appeal the patent proprietor (respondent) submitted a first and a second auxiliary requests whose wording is not relevant for the decision, as well as the following document:

D11: Declaration by A. Marrani dated 29 April 2019 and experimental report.

- VI. Following the rejoinder, but before the notification of the summons to oral proceedings, the following documents were submitted by the appellant:

D12: Q.M. Zhang *et al.* POLY(VINYLDENE FLUORIDE) (PVDF) AND ITS COPOLYMERS, Encyclopedia of Smart Materials,

D12a: screenshot of <https://doi.org/10.1002/0471216275.esm063> showing the publication date of D12 and

D13: WO 2018/065306 A1.

- VII. Oral proceedings before the Board were held on 4 May 2022.

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

- IX. The respondent requested that the appeal be dismissed, or alternatively that the decision under appeal be set aside and the patent be maintained in amended form on the basis of the claims of one of the first or second

auxiliary requests filed with the reply to the statement of grounds of appeal.

X. The appellant's submissions, in so far as they are pertinent, may be derived from the reasons for the decision below. They are essentially as follows:

(a) D9 and D10 should be admitted into the proceedings, while D11 should not.

(b) The claimed invention lacked an inventive step starting from each of D1, D2 and D4 as the closest prior art.

XI. The submissions of the respondent, in so far as they are pertinent, may be derived from the reasons for the decision below. They are essentially as follows:

(a) D11 should be admitted into the proceedings, while D9 and D10 should not.

(b) The claimed invention was not obvious starting from either D2 or D4 as closest prior art, while D1 did not constitute a suitable starting point for assessing inventive step.

Reasons for the Decision

Admittance of D9 and D10

1. The admittance of D9 and D10 filed by the appellant with the statement of grounds of appeal is subjected to the provisions of Article 12(4) RPBA 2007 which applies in view of Article 25(2) RPBA 2020.

The appellant argues that D9 and D10 were submitted in response to an oversight by the opposition division that the semi-crystalline fluoropolymers of D1 comprising recurring units of VDF and TrFE in specific amounts would have ferroelectric properties. This, however, is a misreading of the reasons for the contested decision in which it was held that D1 does not disclose a copolymer comprising VDF and TrFE repeating units, and in addition is silent about a ferroelectric copolymer (page 4, point 2.3.2.2 of the decision).

The appellant also argues that the admittance of D9 and D10 should not depend on the disclosure of D1, since D9 and D10 are cited as an illustration of common general knowledge in order to show that it was known in the art that "*fluoropolymers comprising recurring units of VDF and TrFE in specific amounts are semi-crystalline fluoropolymers, and that such semi-crystalline fluoropolymers have ferroelectric properties*".

However, documents D3 and D4, submitted with the notice of opposition, have been also relied upon by the appellant in the statement of grounds of appeal in order to illustrate that copolymers of VDF and TrFE are piezo-, pyro- and ferro-electric (page 5/16, first paragraph), i.e. in essence the same information as alleged to be provided with D9 and D10. Moreover, the appellant's argument that the information content of D9 and D10 could not come as a surprise to the respondent, since these documents merely confirm the teaching of the background art indicated in the patent in suit, underlines the absence of necessity to file those documents when the respondent does not deny the

accuracy of the statements made in the patent in suit concerning the background art.

In these circumstances, the Board cannot find any justification for the filing of D9 and D10 only in appeal and accordingly makes use of its discretionary power under Article 12(4) RPBA 2007 not to take into account those documents.

Admittance of D11

2. The admittance of D11 filed by the respondent with the reply to the statement of grounds of appeal is also subjected to the provisions of Article 12(4) RPBA 2007.

The only new information concerning the substance of the case contained in D11 concerns the maximum polarization P_{Max} and residual polarization P_r values of a material corresponding to that prepared in example 8C of the patent in suit. On that basis the respondent argues that the polymers of inventive examples 4 and 6 of the opposed patent, comprising units derived from azide monomers, possess substantially the same ferroelectric properties as the corresponding VDF-TrFE copolymer, deprived of any modifying azide unit.

The opposition division decided that in the absence of a comparative example which would illustrate an unmodified VDF-TrFE copolymer the opposed patent failed to demonstrate that a VDF-TrFE copolymer according to the present invention retained 100% of the ferroelectric properties of the corresponding unmodified polymer (page 5, fourth full paragraph of the decision). The appellant submits that the absence of comparative data was already discussed in the first instance, as allegedly admitted by the proprietor

itself, reference being made to a letter of the proprietor allegedly filed on 16 May 2017 (but not contained in the file available to the Board).

Having regard to opposition file, the absence of experimental evidence showing that a VDF-TrFE copolymer according to the present invention retained 100% of the ferroelectric properties of the corresponding unmodified polymer was addressed by the opponent for the first time during the oral proceedings (minutes, page 1, third paragraph of the section "main request" and page 2, fourth full paragraph). Under these circumstances, the submission of D11 by the respondent with the rejoinder is in direct response to that objected lack of experimental evidence. In other words, the submission of D11 at this stage of the opposition-appeal proceedings is legitimate so that the Board makes use of its discretionary power under Article 12(4) RPBA 2007 to take document D11 into account.

Admittance of D12, D12a and D13

3. The admittance of D12, D12a and D13 which were filed by the appellant after the statement of grounds of appeal, but before notification of the summons to oral proceedings, is subject to the stipulations of Article 13(1) RPBA 2020. As put forward by the appellant D12, D12a showing the publication date of D12 and D13 were submitted to refute the respondent's assertions according to which (i) the Curie temperature may be equal to the melting temperature and (ii) comparative polymer 8C has a residual polarization of about $2 \mu\text{C}/\text{m}^2$, as allegedly supported by D11. On that basis and in view of the absence of any objection to their admittance by the respondent, the Board makes use of

its discretion pursuant to Article 13(1) RPBA 2020 and admits D12, D12a and D13 into the proceedings.

4. The sole substantive issue in dispute is inventive step, whereby three separate objections starting from the disclosure of either D1, D2 or D4 were submitted by the appellant. Whereas it is undisputed that D2, or D4, which contains a similar teaching, represents a suitable starting point for assessing inventive step, the appellant also argues that D1 can be taken as the closest prior art, which is disputed by the respondent.

Inventive step starting from D1

5. According to the case law (Case Law of the Boards of Appeal of the EPO, 9th Edition, 2019, I.D.3.2) ideally the closest prior art should be a document that mentions the purpose or objective indicated in the patent in suit as a goal worth achieving. The aim thereof is that the assessment process should start from a situation as close as possible in reality to that encountered by the inventor, avoiding *ex post facto* considerations.

According to paragraph [0014] of the specification, the aim of the present invention was to provide VDF-TrFE copolymer materials which can efficiently undergo crosslinking under thermal or UV exposure conditions, yielding a uniformly cured material which still maintains outstanding piezoelectric, ferroelectric, pyroelectric and dielectric properties.

6. The appellant argues that D1 discloses semi-crystalline fluoropolymers (reference being made to paragraph [0024]) which comprise recurring units of monomers including VDF (i.e. VF₂ in D1), TFE and/or TrFE,

wherein VDF and TFE monomers are listed amongst preferred monomers in paragraph [0022] of said document. The polymers are also indicated in paragraph [0021] to comprise from 0.02 to 10 mol.% of units of fluoroalkanesulfonyl azide compounds. Concerning the achievement of ferroelectric properties, those are according to the appellant inherent in the combined use of VDF and TrFE, reference being made to D3 and D4.

- 6.1 Paragraph [0022] of D1 defines a list of monomers suitable for forming copolymers with the fluoroalkanesulfonyl azide compounds (I) and (II) defined in paragraphs [0014] (or claim 1) and [0016] (or claim 3), respectively. This list of comonomers in paragraph [0022], however, does not provide a direct and unambiguous disclosure for a copolymer comprising in addition to a compound of formula (I) or (II) both monomeric units derived from VDF and TrFE.
- 6.2 Moreover, the indication by the appellant that the fluoropolymers envisaged in D1 are semi-crystalline merely represents one option disclosed in paragraph [0024] of D1, as this passage also refers to amorphous copolymers. Accordingly, the mere disclosure in D1 of VDF, TFE and/or TrFE is also not necessarily to be read in the context of semi-crystalline copolymers. Furthermore, having regard to paragraph [0032], the copolymers prepared in the examples of D1 are either partially crystalline, in which case a melting temperature T_m was measured, or non-crystalline in which case a T_g value was measured. In view of the T_m and T_g measurements described in the examples of D1, the sole copolymers exemplified in D1 which are disclosed to be partially crystalline are those described with examples 8 and 11, which both comprise TFE, but no VDF or TrFE units. The other copolymers

exemplified in D1 comprise either TFE or VDF. They are all amorphous having regard to the indication of a T_g value.

6.3 Apart from an implicit disclosure of ferroelectric properties, based on the alleged disclosure of copolymers comprising VDF and TrFE repeating units, no indication for such properties in D1 was put forward by the appellant. D1 merely address the use of the materials described in D1 "*in the areas of curable elastomers and elastoplastics, adhesion enhancement, coatings, thermosetting resins, grafting polymers and the like*" (paragraph [0013]). It does not address electric properties of the materials described in D1, let alone piezoelectric, ferroelectric, pyroelectric and dielectric properties which are at the core of the invention described in the patent in suit.

6.4 Summing up, reading into D1 that this prior art discloses copolymers comprising VDF and TrFE repeating units or using that document as starting point for assessing inventive step when it does not relate to the aim of the present invention, i.e. crosslinking VDF-TrFE copolymer materials while maintaining their piezoelectric, ferroelectric, pyroelectric and dielectric properties, can only be the result of an inadmissible analysis of D1 made with the hindsight knowledge of the invention described in the patent in suit, as is submitted by the respondent.

6.5 Therefore, the appellant's objection that the subject-matter of claim 1 lacks an inventive step starting from the disclosure of D1 fails to convince.

Inventive step starting from D2

Closest prior art

7. D2 describes in paragraph [0052] a composition comprising:
- (i) a ferroelectric fluoropolymer consisting of VDF and TrFE recurring units, whereby the TrFE recurring units are comprised in an amount of 50 wt.%, i.e. 43.83 mol.%, and
 - (ii) 10 wt% of 2,6-bis(4-azidebenzylidene)-4-methyl-cyclohexanone (based on the amount of copolymer) as a photosensitive crosslinking agent.

A layer of this composition is spincoated onto a substrate, the coated material being crosslinked by exposure to light of an appropriate wave length (paragraph [0054]). According to paragraph [0055] the patterned ferroelectric polymer layer may be annealed to enhance the ferroelectric properties.

D2 is already mentioned in paragraph [0011] of the specification as a possible starting point for the present invention.

Under these conditions and in agreement with the parties, the Board is satisfied that the copolymer of VDF and TrFE described in paragraph [0052] of D2 represents the closest prior art.

Distinguishing feature

8. It is also a matter of consensus that the fluoropolymer of operative claim 1 differs from the closest prior art solely in that it comprises from 0.01% to 10% by moles

of recurring units derived from at least one monomer comprising an azide group.

Problem successfully solved

9. Concerning the question of which problem is successfully solved over the closest prior art by the incorporation of 0.01% to 10% by moles of recurring units derived from at least one monomer comprising an azide group, the respondent referred as before the opposition division to the crosslinkability of the resulting fluoropolymers and their ferroelectric properties after crosslinking.

Crosslinking behaviour

10. Concerning the crosslinking behaviour, the respondent submitted in line with the finding of the opposition division that the claimed fluoropolymers undergo under reasonably mild conditions (UV exposure for 4 seconds, heating at 130°C for 20 minutes) a more effective crosslinking than fluoropolymers which do not contain recurring units derived from at least one monomer comprising an azide group, the same effect being observed when the fluoropolymer of the closest prior art is also used in combination with a bis-azide crosslinking agent. The respondent refers in this respect to the experimental results shown in tables 2, 4 and 5 of the specification.
 - 10.1 In the whole of the written submissions, the sole argument of the appellant concerning the lack of probative value of said mentioned experimental evidence was based on the allegation that the respondent's comparative tests could not demonstrate that the distinguishing feature was causative for the alleged

beneficial improvement of crosslinking behaviour, since the copolymers compared did not solely differ by the presence (or absence) of cure sites as repeating units derived from at least one monomer comprising an azide group. The polymers compared were argued to also differ in the nature of the other repeating units of the polymers tested, since the polymers according to the invention would comprise TrFE repeating units, whereas the polymer of the comparative example 8C would comprise TFE repeating units.

The respondent, however, submitted in the footnote on page 9 of the rejoinder that the comparative fluoropolymer of example 8 described in paragraph [0133] of the specification must be understood to comprise TrFE recurring units rather than TFE units.

The Board agrees with the respondent that the skilled person reading the specification as a whole would understand in the light of the composition of the gas phase indicated on page 17, line 5 and paragraphs [0137] and [0144] addressing the properties of the VDF-TrFE polymer free from recurring units of type (Az), which in the context of paragraphs [0137] and [0144] can only mean the polymer of example comparative 8C, that the term "TFE" mentioned twice in paragraph [0133] can only read "TrFE". This, having regard to the paragraph bridging pages 5 and 6 of the reasons for the decision, was the understanding of comparative example 8 by the opposition division. This conclusion reached on the basis of the respondent's written submissions provided with their rejoinder was also indicated as a preliminary opinion in points 21 to 21.3 of the Board's communication sent in preparation for the oral proceedings.

10.2 On the day of the oral proceedings the appellant brought forward for the first time during the opposition appeal proceedings additional arguments as to why the comparative data contained in the patent in suit were not suitable to demonstrate an improvement of the crosslinking behaviour caused by the use of cure sites as repeating units derived from at least one monomer comprising an azide group.

10.2.1 The appellant argued that example 4 and comparative example 8 of the patent in suit could not demonstrate that alleged effect, since the compositions compared also significantly differ in the molecular weight of the fluoropolymer, the molecular weight of the fluoropolymer employed in comparative example 8 being three times higher. In addition comparative example 8 would not be a true reproduction of the closest prior art, as the azide external crosslinking agent used in comparative example 8 comprises an aliphatic chain, whereas the external azide agent used in the closest prior art, namely 2,6-bis(4-azidebenzylidene)-4-methylcyclohexanone, comprises instead cyclic and aromatic groups.

Another reason for the lack of probative value of these comparative tests was in the appellant's opinion that the fluoropolymer of the closest prior art is crosslinked under certain conditions using a specific wavelength and a nitrogen atmosphere, whereas the crosslinking is performed in the experimental part of the patent in suit with a thermal treatment or a UV treatment whose wave length is unknown.

Furthermore, the data relating to the curing of comparative example 8 (table 5) would not be credible as such and should be already disregarded for this

reason, since the presence of an internal crosslinker would necessarily lead to a crosslinking reaction, if proper crosslinking conditions, including an appropriate wavelength, had been selected.

On that basis, the appellant submitted that the effect of an improved crosslinking ability, for which the sole evidence relied upon were the experiments contained in the patent in suit, could not be retained for the formulation of the problem solved over the closest prior art.

- 10.2.2 According to Article 13(2) RPBA 2020, any amendment to a party's appeal case made after notification of a summons to oral proceedings shall, in principle, not be taken into account unless there are exceptional circumstances, which have been justified with cogent reasons by the party concerned.

The new appellant's submissions made on the day of the oral proceedings were justified by the appellant by the need to reconsider their position in view of the Board's preliminary opinion provided in the communication dated 4 April 2022. However, as indicated in above point 10.1 the Board's preliminary view concerning the appellant's submissions that the experimental tests contained in the patent in suit lacked probative value were only based on the respondent's arguments and the reasons for the contested decision. An indication of the Board's preliminary opinion on certain issues addressed in the communication sent for preparing oral proceedings which is solely based on the parties' submissions, i.e. without any additional point introduced by the Board, does not represent an exceptional circumstance, but rather the norm as "In most cases, the Board will give

a preliminary opinion in its communication"
(Supplementary publication 1, OJ EPO 2020, page 223,
explanatory notes to Article 15(1) RPBA 2020).

Moreover, in applying Article 13(2) RPBA 2020 the Board may also rely on the criteria defined in Article 13(1) RPBA 2020 (Supplementary publication 1, supra, page 221, explanatory notes to Article 13(2) RPBA 2020), those including the current state of the proceedings and the need for procedural economy.

In this respect, the Board agrees with the respondent that the appellant's new submissions made at the latest possible point in the procedure, i.e. during the oral proceedings, put the respondent in the impossibility to properly address these new issues, which in fact would have necessitated to adjourn the oral proceedings in respect of the right to be heard and the right to a fair hearing. The fact that the respondent might have been aware that D4, whose teaching is similar to that of D2 and is addressed in paragraph [0011] of the patent in suit, employs a crosslinking agent which is different from that used in the comparative tests of the patent in suit, means at most that the respondent could be aware of that difference. It does not mean that the respondent was aware that this could cast doubts on the probative value of these comparative tests, let alone that submissions in this respect were to be expected.

On that basis, the new submissions concerning the lack of probative value of the experimental data of the patent in suit which were brought forward by the appellant at the oral proceedings are not taken into account pursuant to Article 13(2) RPBA 2020.

- 10.3 On that basis, the Board has no ground to deviate from the finding of the opposition division concerning the crosslinking ability of the claimed fluoropolymers. It is therefore accepted that the claimed fluoropolymers exhibit in comparison to that of the closest prior art an improved crosslinking ability.

Ferroelectric properties

11. Concerning the ferroelectric properties of films prepared with the claimed fluoropolymers, the respondent referred in writing to the results shown in table 1 of the specification and those reported in D11. However, as pointed out by the appellant the comparison offered in table 1 with examples 4 to 7 and comparative example 8C in the specification or with examples 4 and 6 and the re-working of comparative example 8 in D11 cannot demonstrate an effect caused by the incorporation of repeating units bearing azide groups on the ferroelectric properties, since the molecular weight of the copolymer of comparative example 8 is much higher than the molecular weight of the fluoropolymers of examples 4 to 7. In this respect, the appellant's argument that a decrease of the molecular weight would favour the formation of the so-called crystalline beta-phase which is linked to ferroelectric properties of the fluoropolymers (specification, paragraph [0007]) was not disputed by the respondent.

Moreover, while the appellant explicitly submitted that the semi-crystalline fluoropolymer of granted claim 1 exhibits some ferroelectric properties, the respondent accepted at the oral proceedings that no experimental data had been submitted proving that the incorporation of recurring units derived from at least one monomer comprising an azide group would as such

allow to keep the same level of ferroelectric properties, let alone the achievement of outstanding properties in this respect, as had been put forward by the respondent in their rejoinder.

12. Under these circumstances, the problem successfully solved by the fluoropolymers of claim 1 over the closest prior art can be formulated as the provision of fluoropolymers possessing some ferroelectric properties and improved crosslinking ability.

Obviousness of the solution

13. It remains to be decided whether the skilled person desiring to solve the problem identified above would, in view of the disclosure of D2, possibly in combination with other prior art documents or with common general knowledge, have modified the fluoropolymer described in paragraph [0052] of D2 in such a way as to arrive at fluoropolymers of operative claim 1. The sole prior art documents referred to by the appellant concerning obviousness of the claimed solution are D2 and D1.

- 13.1 No argument was submitted by the appellant as to why the skilled person would have found it obvious to modify the copolymer of the closest prior art by introducing 0.01% to 10% by moles of recurring units derived from at least one monomer comprising an azide group in order to improve its crosslinking ability, let alone under relatively mild curing conditions.

Moreover, no prior art dealing with crosslinked polymers which exhibit ferroelectric properties and have been obtained by crosslinking copolymers having an

internal crosslinker has been cited by the appellant either.

13.2 It is also undisputed that D2 does not teach the use of an internal crosslinker. The sole crosslinking methods described in D2 are the use of external crosslinkers such as bisazide, diazoquinone, azo, azide or diazo compounds with the use of a suitable radiation energy in accordance with the invention of D2 (paragraphs [0043], [0044], [0048], [0052] and [0054]) or exposure to oxygen plasma, addition of a chemical reagent such as a peroxide or use of a base such as bisamine, the latter being reported in paragraphs [0033] to [0035] when discussing the prior art relative to D2.

13.3 As correctly noted by the appellant paragraph [0039] of D2 teaches that other ferroelectric polymers, such as for example nylons, cyanopolymers (polyacrylonitriles), poly(vinylidene cyanide) and polymers with a cyano group in the side chain, polyureas, polythioureas and polyurethanes, may also be used in the context of D2.

Paragraph [0039] of D2, however, does not concern the formation of semi-crystalline polymers comprising an internal crosslinker, let alone one comprising an azide group. The appellant's argument that the skilled person would not be discouraged in view of this passage of D2 from incorporating additional monomers into the ferroelectric copolymer of VDF and TrFE of the closest prior art, as long as the relative proportions of VDF and TrFE recurring units are within the well-known ranges for ensuring that the obtained fluoropolymer exhibit ferroelectric properties is in the Board's conviction tainted with hindsight and for this reason not convincing.

While the need to control the amount of crosslinking repeating units would appear obvious to the reader of the patent in suit, in the sense that it appears logical based on the information provided therein, for a proper assessment of the inventive step one should take care of separating the information known to the skilled person at the date of filing from the one which is the contribution of the inventor.

In the present case, in the absence of evidence to the contrary it was the inventor's contribution to have incorporated an effective internal crosslinker into fluoropolymers comprising units derived from VDF and TrFE, while obtaining polymers exhibiting ferroelectric properties.

- 13.4 Furthermore, as can be taken from above points 6 to 6.3, D1 does not concern fluoropolymers exhibiting ferroelectric properties.

Whereas some of the fluoropolymers envisaged in D1 are semi-crystalline, as indicated in above point 6.2, the sole semi-crystalline copolymers specifically described in that document are those of examples 8 and 11, which do not comprise VDF or TrFE repeating units.

As pointed out by the respondent, D1 has not been shown to teach or even suggest that the copolymerization of recurring units derived from at least one monomer bearing a large group such as an azide group should not be expected to prevent the formation of the so called crystalline beta-phase to which the piezo-, pyro- and ferroelectric properties in copolymers of VDF with TrFE is related (paragraph [0007] of the patent in suit).

Faced with the problem identified in above point 12, i.e. providing a fluoropolymers possessing not only improved crosslinking ability, but some ferroelectric properties (emphasis added by the Board), it is only with the benefit of hindsight that the skilled person would look for a solution into D1, which does not concern polymers exhibiting piezoelectric, ferroelectric, pyroelectric or dielectric properties, let alone copolymers comprising VDF and TrFE repeating units, which are not disclosed in that document.

14. On that basis the appellant's objection that the semi-crystalline fluoropolymers of operative claim 1 are obvious to a person skilled in the art having regard to the disclosure of documents D2 and D1 and therefore lack an inventive step must be rejected.

Inventive step starting from D4

15. Both parties consider that D4 and D2 comprise a similar disclosure in providing a method of creating a layer of a crosslinked ferroelectric polymer such as a VDF-TrFE random copolymer by using a crosslinking agent of the bis-azide type (statement of grounds of appeal, page 6, last paragraph and page 13, second paragraph; rejoinder, page 6, point 3.2.1, first paragraph). It is undisputed that D4 represents an additional suitable starting point for assessing inventive step.
16. Having regard to the similarity of the teachings of D2 and D4, it is also undisputed that the sole feature distinguishing the subject-matter of operative claim 1 from the disclosure of D4 is the inclusion in the ferroelectric polymer to be crosslinked of from 0.01% to 10% by moles of recurring units derived from at least one monomer comprising an azide group.

17. As to the problem successfully solved over said teaching of D4 by the semi-crystalline fluoropolymer of claim 1, it can be formulated as in above point 12 as the provision of fluoropolymers possessing some ferroelectric properties and improved crosslinking ability. In this respect the same reasons as provided in above points 10.1, 10.3 and 11 apply. Even if to the benefit of the appellant, one took into account for the objection starting from D4 as the closest prior art the additional submissions made at the oral proceedings in relation to D2 given in above point 10.2, which the appellant in fact did not since they merely referred during the oral proceedings to their written submissions for the objection starting from D4 as the closest prior art, the same conclusion concerning the non-admittance of this additional submission would have been arrived at for the reasons given in above point 10.2.1 and 10.2.2.

18. Regarding obviousness of the solution, for the same reasons as provided in above points 13.1 to 13.4, it must be concluded that the semi-crystalline fluoropolymers of operative claim 1 are not obvious to a person skilled in the art having regard to the teaching of D4 and D1, in particular since it is only with the knowledge of the patent in suit that the skilled person would consider D1 for providing copolymers having ferroelectric properties.

19. The additional claims concern semi-crystalline fluoropolymers within the ambit of claim 1 (claims 2 to 9), a process for the manufacture of a semi-crystalline fluoropolymer according to any one of claims 1 to 9 (claim 10), a crosslinkable composition comprising the semi-crystalline fluoropolymer according to any one of

claims 1 to 9 (claims 11 and 12), a method of crosslinking the semi-crystalline fluoropolymer according to any one of claims 1 to 9 or the composition according to any one of claims 11 to 12, for yielding a cured article (claim 13) or a method for manufacturing one of electrical and electronic devices, comprising using a semi-crystalline fluoropolymer according to any one of claims 1 to 9.

20. It is undisputed that any positive finding in relation to inventive step of claim 1 would also be valid for additional claims 2 to 15, as the definition of these claims encompasses all the features of present claim 1.

21. In the absence of additional objections against the subject-matter of the granted claims, the respondent's main request is allowable. There is therefore not need to consider the first and second auxiliary requests.

Order

For these reasons it is decided that:

The appeal is dismissed

The Registrar:

The Chairman:



B. ter Heijden

D. Semino

Decision electronically authenticated