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**Datasheet for the decision  
of 24 January 2023**

**Case Number:** T 0930/19 - 3.3.10

**Application Number:** 09711602.4

**Publication Number:** 2254851

**IPC:** C07C17/383, C07C17/386,  
C07C21/18, C01B7/19, C07C17/38

**Language of the proceedings:** EN

**Title of invention:**

AZEOTROPE COMPOSITIONS COMPRISING 3,3,3-TRIFLUOROPROPENE AND  
HYDROGEN FLUORIDE AND PROCESSES FOR SEPARATION THEREOF

**Patent Proprietor:**

The Chemours Company FC, LLC

**Opponent:**

ARKEMA FRANCE

**Headword:**

**Relevant legal provisions:**

**Keyword:**

**Decisions cited:**

**Catchword:**



**Beschwerdekammern**

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**Chambres de recours**

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Case Number: T 0930/19 - 3.3.10

**D E C I S I O N**  
**of Technical Board of Appeal 3.3.10**  
**of 24 January 2023**

**Appellant:** ARKEMA FRANCE  
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**Decision under appeal:** **Decision of the Opposition Division of the European Patent Office posted on 5 February 2019 rejecting the opposition filed against European patent No. 2254851 pursuant to Article 101(2) EPC.**

**Composition of the Board:**

<b>Chair</b>	P. Gryczka
<b>Members:</b>	R. Pérez Carlón
	F. Blumer

## Summary of Facts and Submissions

I. The appellant (opponent) lodged an appeal against the decision of the opposition division rejecting the opposition against European patent No. 2 254 851.

II. Notice of opposition had been filed on the grounds of added subject-matter (Article 100(c) EPC), insufficiency of disclosure (Article 100(b) EPC) and lack of inventive step (Article 100(a) EPC).

III. The documents filed included the following:

D1	WO 2008/024508 A1
D3	WO 2007/053736 A2
D5	WO 2007/053688 A2
D6	WO 2007/053177 A1
D7	US 2006/0106263 A1

IV. The patent as granted is the respondent's (patent proprietor) main request in these appeal proceedings. Claim 1 reads as follows:

*"A process for separating a mixture comprising HF and HFC-1243zf, said process comprising:*

*a. feeding the composition comprising HF and HFC-1243zf to a first distillation column;*

*b. removing an azeotropic or azeotrope-like composition consisting essentially of from 67.2 to 82.5 mole percent HFC-1243zf and from 32.8 to 17.5 mole percent HF, said composition having a vapor pressure from 8.0 psia (55.2 kPa) to 817 psia (5633 kPa) at a temperature from -40°C to 110°C, as a first distillate and either i) HF or ii) HFC-1243zf, as a first column*

*bottoms composition;*

*c. condensing the first distillate to form two liquid phases, being i) an HF-rich phase and ii) a HFC-1243zf-rich phase, and*

*d. recycling a first liquid phase enriched in the same compound that is removed as the first column bottoms, said first liquid phase being either i) HF-rich phase or ii) HFC-1243zf-rich phase, back to the first distillation column."*

Like claim 1, independent claim 6 requires distilling an azeotrope as defined in step b of claim 1 and condensing this distillate to form two liquid phases, one of which is recycled.

V. The opposition division concluded that claim 1 of the patent had the required basis in claims 1 and 3 of the application as originally filed. The claimed invention was sufficiently disclosed for it to be carried out by a person skilled in the art. The right to priority had been validly claimed, and the claimed processes were novel over that disclosed in D1. Document D7 was the closest prior art. The problem underlying the claimed invention was to provide an alternative efficient separation process of HFC-1243zf. The claimed solution, characterised by separating a first azeotropic or azeotropic-like distillate and condensing it to form two liquid phases, would not have been obvious for a skilled person and was thus inventive.

VI. The appellant's arguments were as follows.

Step b of originally filed claim 3 required removing an azeotropic composition. Step b of claim 1 of the patent as granted included not only removing an azeotrope but also an azeotrope-like composition, further defined in

terms of its composition and vapour pressure. For this reason, claim 1 contained subject-matter not originally disclosed.

The patent did not contain sufficient information on the operating conditions of the distillation column required by claim 1. For this reason, the claimed invention was not sufficiently disclosed to be carried out by a skilled person.

The combination of claims 1 and 16 of D1 with the temperature and pressure disclosed on page 32, lines 2 to 6 disclosed all the features of the process of claim 1, which was for this reason not novel. As document D1 disclosed the same subject-matter earlier than the priority document, the right to priority had not been validly claimed.

Document D7 was the closest prior art. It disclosed all the features of claim 1 with exception of the composition and vapour pressure of the azeotrope required by claim 1. For want of a direct comparison between the claimed process and that of D7, the problem underlying the claimed invention was to provide an alternative process for separating HF and HFC-1243zf. The solution, which was only characterised by the composition and vapour pressure of the azeotrope required by step b of claim 1, would have been a straightforward choice for a skilled person in view of the temperature and pressure conditions used for similar separations involving azeotropes (D3, D5). The claimed process was thus not inventive.

VII. The respondent's arguments were as follows.

The application as originally filed disclosed that the

term "azeotropic" included both azeotropic and azeotropic-like compositions. For this reason, claim 1 did not relate to subject-matter not originally disclosed.

Even in the absence of an example according to claim 1, a skilled person would find no difficulty in putting the claimed invention into practice. Finding the operating conditions of a distillation column was within their skills.

D1 did not disclose, in combination, the separation of HF from HFC-1243zf and the conditions for the separation on page 32, lines 2 to 6, as required by the claims of the patent. It did thus not disclose the invention before the priority document. The document from which the right to priority was claimed was word-for-word identical to the application as originally filed. Therefore, if the patent did not go beyond the application as originally filed, the priority date should be acknowledged.

Document D7 was the closest prior art. It disclosed neither the composition and vapour pressure of the azeotrope required by step b of claim 1, nor the condensation of that azeotrope to form two liquid phases as required by step c, nor the recycling of one of them required by step d of claim 1. The problem underlying the claimed invention was to provide a more efficient process for separating HF and HFC-1243zf. Even if the technical problem were seen only as to provide an alternative, the claimed solution would not have been obvious for a skilled person and was thus inventive.



VIII. The board informed the parties in a communication dated 21 August 2020 that it was likely to dismiss the appeal.

IX. Oral proceedings before the board took place on 24 January 2023.

X. The parties' final requests were as follows.

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

The respondent requested that the appeal be dismissed (main request). Alternatively, it requested that the patent be maintained with the claims of one of auxiliary requests I to V, auxiliary requests I to IV as filed with the reply to the grounds of appeal dated 23 October 2019, and auxiliary request V as filed with a letter dated 8 December 2022.

XI. At the end of the oral proceedings, the decision was announced.

### **Reasons for the Decision**

1. The appeal is admissible.

2. Amendments

2.1 Claim 1 of the patent as granted has the features of the process of claim 3 as originally filed. Original claim 3 required the first distillate of step b to be "an azeotrope composition comprising HF and HFC-1243zf".

Claim 1 of the patent as granted requires the first

distillate of step b to be "an azeotropic or azeotrope-like composition consisting essentially of from 67.2 to 82.5 mole percent HFC-1243zf and from 32.8 to 17.5 mole percent HF, said composition having a vapor pressure from 8.0 psia to 817 psia at a temperature from -40°C to 110°C". This composition represents the subject-matter of claim 2 as originally filed, which does not relate to a process.

2.2 The appellant argued that claim 3 as originally filed required an azeotrope and thus did not include an azeotrope-like composition.

2.3 However, in view of page 9, lines 28 and 29 of the description, the term "azeotrope" includes azeotrope-like compositions. The components' proportions and vapour pressure of the azeotrope required by claim 1 are detailed in claim 2 as originally filed. The features of claim 1 have thus been disclosed in combination in the application as originally filed and thus have the required basis.

2.4 The ground for opposition set by Article 100(c) does not preclude the maintenance of the patent as granted.

3. Sufficiency of disclosure

3.1 It was not disputed that HF and HFC-1243zf form an azeotropic composition at the temperature and pressure set by claim 1 of the main request.

It was also not disputed that such an azeotrope would separate into two phases upon condensation.

It was also agreed between the parties that none of the patent's examples were embodiments of the claimed

invention.

- 3.2 The appellant argued that example 2 of the patent disclosed a process whose first distillate did not have the composition required by claim 1. Table 1 of the patent disclosed that the relative amount of HF in the azeotrope decreased by increasing the temperature. However, the results of the additional example A9, submitted by the respondent during opposition and carried out at a temperature higher than that in example 2 of the patent, showed exactly the contrary. Example A9 did not arrive at a first distillate according to claim 1, either. Paragraph [0068] of the patent disclosed that the column's operating conditions would depend upon the HFC-1243zf being purified and the relative amount of this compound and HF in the composition.

The appellant concluded that the skilled person found no teaching in the patent on how to carry out a process leading to obtaining a first distillate having a composition within the boundaries set by step b of claim 1. The claimed invention was for this reason not sufficiently disclosed for it to be carried out by a skilled person.

- 3.3 The appellant has not questioned the existence of the azeotrope required by claim 1. Inevitably, distillation conditions which imply the distillation of the azeotrope thus exist. Azeotropes are frequent in the field (see D3, D5, D6) and behave as a single compound under distillation conditions. Distillation is a standard technique in the field of halocarbons. The control of distillation processes is within the knowledge of a skilled person, who would thus have no difficulty in finding the conditions that would lead to

distilling the azeotrope sought. This is the case regardless of whether the proportion of HF increases or decreases with the temperature and the component amounts in the starting material.

3.4 The claimed invention is thus sufficiently disclosed for it to be carried out by a skilled person. The ground for opposition set out in Article 100(b) EPC does not preclude the maintenance of the patent as granted.

4. Novelty

4.1 Document D1 was published between the priority and the filing date of the patent. It was undisputed that D1 was prior art for the issue of novelty, either as defined in Article 54(3) or Article 54(2) EPC.

4.2 It was not disputed that claim 1 of D1 disclosed a process which differed from that of claim 1 of the patent as granted by:

- relating to a mixture of HF and a fluoroolefin in general and not specifically to a mixture of HF and HFC-1243zf
- requiring an azeotrope comprising HF and a fluoroolefin and not specifically HFC-1243zf
- not requiring this azeotrope to have the composition and vapour pressure defined in claim 1 of the patent

4.3 Claim 16 of D1 depends on claim 15, which is dependent on claim 1. Claim 16 limits the fluoroolefin to be separated by the process of claim 1 to a group of four; one of them being HFC-1243zf.

Claim 1 of the patent requires the azeotrope obtained

as the first distillate in step b to have a defined composition and vapour pressure. It was undisputed that not every azeotrope of HF and HFC-1243zf must inevitably have these properties. The appellant nevertheless argued that the azeotrope in step b of claim 1 would inevitably be obtained by the process of D1 having regard to the operating temperature and pressure of the distillation column on page 32, lines 3 to 6.

However, these conditions are not combined specifically with the separation of HFC-1243zf. The paragraph of the description preceding the one the appellant cited discloses that the operating conditions of the distillation columns "will depend upon the fluoroolefin being purified and the relative amounts of HF and fluoroolefin in the composition to be separated". This is also reflected in paragraph [0068] of the patent. As D1 does not disclose these features in combination, the claimed process is novel for this reason alone.

## 5. Priority

- 5.1 The appellant questioned the validity of the claimed priority right arguing that D1 was the first application disclosing the claimed invention. A subsequent application on the same subject-matter could not provide a right to priority (Article 87(4) EPC).

However, since D1 does not disclose the claimed invention, it is not "the first document disclosing the invention".

- 5.2 It was not disputed that the document from which the right to priority was claimed is word-for-word identical to the application as originally filed. The

priority date is thus validly claimed with the consequence that D1 is prior art under Article 54(3) EPC and cannot be cited for inventive step.

6. Inventive step

6.1 Claim 1 relates to a process for separating a mixture comprising HF and HFC-1243zf. Claim 6 relates to the separation of a mixture containing, in addition, HFC-254fb or HFC-254eb. Both claim 1 and claim 6 require a step of distilling an azeotrope of HF and HFC-1243zf, condensing it to form two phases and recycling one of them.

6.2 Closest prior art

6.2.1 The opposition division and the parties considered that document D7 was the closest prior art. The board sees no reason to disagree.

D7 relates to the production of hydrofluoroolefins by dehydrofluorination. It also concerns their separation from hydrofluorocarbons and HF (abstract). HFC-1243zf is a hydrofluoroolefins obtainable by the method of D7 (Table 1, entries 12 and 13). D7 does not specifically address HFC-1243zf in any other passage.

Paragraph [0067] of D7 discloses that it had been discovered that both hydrofluoroolefins and hydrofluorocarbons may form an azeotrope with HF. This can be used for separating them by azeotropic distillation. The mixture can be distilled to obtain the azeotrope as distillate [0068]. The distillate may be condensed [0076], and a portion may be returned to

the top of the column as reflux.

6.2.2 The appellant argued that the condensation of the distillate inevitably led to two phases, as required by step c of claim 1. D7 thus disclosed all the features of claim 1 with the exception of the composition of the azeotrope in step b.

6.2.3 However, D7 does not specifically disclose the purification of mixtures of HFC-1243zf and HF. In addition, not every azeotrope separates in two phases after cooling, and D7 does not disclose the separation of an azeotrope into two liquid phases upon condensation.

6.2.4 The appellant also argued that by disclosing the use of a second distillation column in which the azeotrope was separated into an HF-rich phase and an olefin-rich phase, D7 also disclosed the condensing of the first distillate to form two liquid phases.

However, step c of claim 1 requires "condensing the first distillate", i.e. the whole of the first distillate. A subsequent distillation is not a step of condensation of the whole azeotropic mixture as specified by claim 1. This argument is thus not convincing.

6.2.5 Technical problem underlying the invention

The parties had different views on the formulation of the technical problem underlying the invention. The appellant defined it as being the mere provision of an alternative. As the claimed solution to this problem would not have been obvious to a skilled person for the reasons which follow, there is no need to examine

whether a more ambitious problem could also have been solved.

#### 6.2.6 Solution

The solution to this technical problem is the process including the azeotropic distillation of claim 1, characterised by the specific azeotrope required and in that this azeotrope is condensed to form two liquid phases, being i) an HF-rich phase and ii) an HFC-1243zf-rich phase, of which the one enriched in the compound obtained as bottoms in the distillation column is recycled.

#### 6.2.7 Success

It was undisputed that the claimed process solves the problem of providing an alternative separation of HF and HFC-1243zf.

#### 6.2.8 It thus remains to be decided whether the proposed solution to the objective problem defined above would have been obvious for the skilled person in view of the prior art.

The prior art does not disclose the separation of any azeotrope into two liquid phases by means of condensation. For this reason alone, the claimed solution would not have been obvious to the skilled person and is thus inventive.

Even if it were known that some azeotropes could separate into two phases, there is no indication in the prior art that this could have been the case for an HFC-1243zf/HF azeotrope.



The skilled person, seeking an alternative process for separating HF and HFC-1243zf, would not have arrived at the claimed solution, which is thus inventive.

- 6.3 The appellant argued that a skilled person would attempt to separate HF and HFC-1243zf by distillation, as disclosed by D7, by using the conditions in D3, D5 and D6, all of them relating to the distillation of azeotropic mixtures. By doing so, a skilled person would inevitably have arrived at the claimed invention.

However, none of these documents disclose the separation of the azeotrope into two liquid phases by condensation, let alone recycling the specific phase required by step d of claim 1. This argument is thus not convincing.

- 6.4 The appellant also argued that optimising the distillation conditions was a routine task for a skilled person, as concluded for sufficiency of disclosure.

However, the prior art does not teach separating the azeotrope, once distilled, into two liquid phases of different composition by condensation. Even if optimising the distillation parameters would inevitably have led to an azeotrope as defined in step b of claim 1, which has not been shown to be the case, step c of claim 1 would not have been obvious for a skilled person.

- 6.5 Like claim 1, independent claim 6 requires the steps of removing an azeotrope of HFC-1243zf of the defined composition and vapour pressure and condensing it to form two liquid phases. The parties agreed that the arguments on inventive step for the process of claim 1

also applied to that of independent claim 6.

6.6 The ground for opposition laid down in Article 100(a) EPC does not preclude the maintenance of the patent as granted.

## Order

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

The appeal is dismissed.

The Registrar:

The Chair:



C. Rodríguez Rodríguez

P. Gryczka

Decision electronically authenticated