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**Datasheet for the decision  
of 19 March 2021**

**Case Number:** T 1337/19 - 3.3.05

**Application Number:** 06827294.7

**Publication Number:** 1948580

**IPC:** C01B7/19, C07C17/15, C07C17/38,  
C07C17/383, C07C21/18,  
C07C17/25

**Language of the proceedings:** EN

**Title of invention:**  
AZEOTROPE COMPOSITIONS COMPRISING E-1,3,3,3-TETRAFLUOROPROPENE  
AND HYDROGEN FLUORIDE AND USES THEREOF

**Patent Proprietor:**  
The Chemours Company FC, LLC

**Opponent:**  
ARKEMA FRANCE

**Headword:**  
Azeotrope compositions/Chemours

**Relevant legal provisions:**  
EPC Art. 123(2), 83, 56

**Keyword:**

Amendments - allowable (yes)

Sufficiency of disclosure - (yes)

Inventive step - (yes)

**Decisions cited:**

T 0199/15

**Catchword:**



**Beschwerdekammern**

**Boards of Appeal**

**Chambres de recours**

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Case Number: T 1337/19 - 3.3.05

**D E C I S I O N**  
**of Technical Board of Appeal 3.3.05**  
**of 19 March 2021**

**Appellant:** The Chemours Company FC, LLC  
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**Decision under appeal:** **Decision of the Opposition Division of the  
European Patent Office posted on 13 March 2019  
revoking European patent No. 1948580 pursuant to  
Article 101(3) (b) EPC.**

**Composition of the Board:**

**Chairwoman** O. Loizou  
**Members:** G. Glod  
T. Burkhardt

## Summary of Facts and Submissions

- I. The appeal of the patent proprietor lies from the opposition division's decision to revoke the European patent EP-B-1 948 580.
- II. The following documents cited in the impugned decision are of relevance here:
- A2: EP 1 067 106 A1  
A5: EP 0 885 863 A1  
A6: EP 0 467 531 A1  
A7: US 5 918 481  
A12: WO 2012/030613 A2
- III. With the statement of grounds of appeal the appellant filed a main request and nine auxiliary requests.
- IV. In the communication pursuant to Article 15(1) RPBA 2020, the board was of the preliminary opinion that the first auxiliary request was allowable.
- V. Oral proceedings took place on 19 March 2021. The appellant withdrew its main request, made the first auxiliary request its main request and renumbered the second to ninth auxiliary requests as the first to eighth auxiliary requests, respectively.
- VI. The only independent claim of said request is as follows:
- "1. A process for the purification of *E*-HFC-1234ze from a mixture of *E*-HFC-1234ze, HFC-245fa, and hydrogen fluoride, wherein greater than 90 mole percent of the

*E*-HFC-1234ze is the trans isomer CAS reg. no.

29118-24-9, said process comprising:

a) subjecting said mixture to a first distillation step to form a first distillate comprising an azeotrope or near-azeotrope composition containing *E*-HFC-1234ze and hydrogen fluoride, and a first bottoms comprising HFC-245fa;

b) subjecting said first distillate to a second distillation step from which a composition enriched in either (i) hydrogen fluoride or (ii) *E*-HFC-1234ze is removed as a second distillate composition with a second bottoms composition being enriched in the other of said components (i) or (ii); and

c) subjecting said second distillate composition to a third distillation step conducted at a different pressure than the second distillation step in which the component enriched in the second bottoms composition in (b) is removed in a third distillate composition with a third bottoms composition enriched in the same component that was enriched in the second distillate composition."

Claim 2 relates to a preferred embodiment.

VII. The appellant's arguments are reflected in the reasons for the decision below.

VIII. The respondent's (opponent's) relevant arguments are summarised as follows:

The requirements of Article 123(2) EPC were not met. Even if it were clear that the compound HFC-43-10mee in claim 20 as filed was an obvious error, it was still not evident what the correction would be. Components other than HFC-245fa, such as *Z*-HFC-1234ze, could be present in the first bottoms.

There was a lack of sufficiency under Article 83 EPC. Claim 1 did not indicate the temperature and pressure at which the mixture of *E*-HFC-1234ze and hydrogen fluoride formed an azeotrope or a near-azeotrope. The results in example 1 of A12 contradicted the results provided in the patent.

The subject-matter of claim 1 lacked an inventive step in view of A7 in combination with A2. A7 was the closest prior art since it also related to purifying fluorocarbons from mixtures of fluorocarbon and hydrogen fluoride. It was not restricted to binary mixtures but included ternary mixtures too, as was evident from column 2, lines 37 to 42. The problem was to provide an alternative method for separating fluorocarbons. The proposed solution was obvious in view of A2, in line with T 199/15. Even if A2 were the closest prior art, the subject-matter of claim 1 would still lack an inventive step in view of the teaching of A7.

- IX. The appellant (patent proprietor) requested that the decision under appeal be set aside and that the patent be maintained in amended form on the basis of the main request, submitted as the first auxiliary request with the statement of grounds of appeal, or, alternatively, on the basis of one of the first to eighth auxiliary requests.
  
- X. The respondent (opponent) requested that the appeal be dismissed.

## Reasons for the Decision

### Main request

1. Article 123(2) EPC

The requirements of Article 123(2) EPC are met for the following reasons:

Claim 1 is based on claim 20 as filed. It is immediately apparent from said claim that the presence of component HFC-43-10mee as part of the first bottoms does not make any technical sense and must be erroneous since "said mixture" in step a) refers to the previously mentioned mixture, that is, of *E*-HFC-1234ze, HFC-245fa and hydrogen fluoride. This mixture does not include HFC-43-10mee. In addition, the distillation step does not change the nature of the components and cannot lead to HFC-43-10mee.

It is also immediately apparent that HFC-43-10mee has to be replaced with HFC-245fa. The process in claim 20 explicitly indicates three components; two of them are part of the distillate formed in step a) and the third is part of the bottoms. The third component must be the one that is not part of the distillate and the one whose discharge is not mentioned in claim 20, namely HFC-245fa. This does not rule out the presence of other components not explicitly mentioned.

2. Article 83 EPC

The board sees no reason to diverge from the opposition division's conclusion with respect to Article 83 EPC (point 2.3 of the reasons).

In paragraphs [0016] to [0028], the patent provides details (including pressures and temperatures) about the azeotropic and near-azeotropic compositions of *E*-HFC-1234ze and hydrogen fluoride. In addition, examples 5 to 11, which were conducted with the *E*-isomer of HFC-1234ze, are relevant for claim 1. There is no evidence that shows that these examples cannot be reworked. The skilled person is able to reproduce the process in claims 1 and 2 on the basis of this information and their knowledge of azeotropic mixtures.

The respondent's assertion that the example in A12 showed that the information provided in the patent was wrong has not been corroborated by facts, as it should have been. In its submissions of 5 March 2018 during the opposition proceedings, the appellant provided a graph (HF weight fraction vs pressure) showing that the data in A12 were erroneous and confirming that the data provided in the patent were correct. There is no proof on file refuting these submissions.

3. Article 56 EPC

3.1 The invention relates to the purification of *E*-HFC-1234ze from a mixture with HFC-245fa and hydrogen fluoride.

3.2 A2 is the closest prior art since it discloses mixtures having exactly these three components as well as the separation of said mixtures (figure, right-hand rectification column "RECTIFIER") into *E*-HFC-1234ze, HFC-245fa and hydrogen fluoride. *E*-HFC-1234ze is drawn off from the upper stage of the rectifier, HFC-245fa is drawn off from the centre of the rectifier and hydrogen



fluoride is drawn off from the bottom of the rectifier (see paragraph [0073]).

A7 is less relevant since it deals with separating fluorocarbons from an azeotropic mixture of the fluorocarbon and hydrogen fluoride (claim 1). Although it does indicate that the azeotropic mixture may be part of any stream along with other components (column 2, lines 37 to 42), there is no disclosure of purifying a single component from a ternary mixture. The azeotropic mixture is already provided within the stream and this azeotropic binary mixture is then further separated. There is no mention of *E*-HFC-1234ze either.

3.3 The problem to be solved is purifying *E*-HFC-1234ze from the mixture of *E*-HFC-1234ze, HFC-245fa and hydrogen fluoride to get a suitable HFC (paragraph [0002] of the patent).

3.4 The problem is solved by a process according to claim 1 that is characterised in that the mixture is subjected to a first distillation step to form a first distillate comprising an azeotrope or near-azeotrope composition containing *E*-HFC-1234ze and hydrogen fluoride, and a first bottoms comprising HFC-245fa; subjecting said first distillate to a second distillation step from which a composition enriched in either (i) hydrogen fluoride or (ii) *E*-HFC-1234ze is removed as a second distillate composition with a second bottoms composition being enriched in the other of said components (i) or (ii); and subjecting said second distillate composition to a third distillation step conducted at a different pressure than the second distillation step in which the component enriched in the second bottoms composition is removed in a third

distillate composition with a third bottoms composition enriched in the same component that was enriched in the second distillate composition.

3.5 It is accepted that the problem is successfully solved since examples 5 to 8 in combination with examples 9 to 11 show that the claimed process steps make it possible to purify *E*-HFC-1234ze. There is no evidence that would call these data into question.

3.6 The solution to the stated problem is not obvious for the following reasons:

A2 relates to the production and purification of HFC-245fa and does not contain any prompt or reason to conduct the distillation in the "RECTIFIER" such that the bottom contains HFC-245fa. Moreover, there is no incentive to separate *E*-HFC-1234ze and hydrogen fluoride from each other in the overhead of the "Rectifier" (paragraph [0033]) since both *E*-HFC-1234ze and hydrogen fluoride are recycled as reactants of the second reaction in the "REACTOR FOR FLUORINATION" to form further HFC-245fa.

Therefore, without the benefit of hindsight knowledge of the invention, there is no reason why the skilled person would have combined A2 with a document that discloses the separation of an azeotrope comprising a fluorocarbon and hydrogen fluoride, such as A7.

Neither A5 nor A6 relates to *E*-HFC-1234ze. Therefore, they do not provide any teaching on how to purify said component from a ternary mixture of *E*-HFC-1234ze, HFC-245fa and hydrogen fluoride.

T 199/15 is not relevant to the facts of this case since the independent process claim 6 on which that decision is based leads to the formation of an azeotrope or near-azeotrope composition and does not include separating the azeotrope composition. Neither HFC-245fa nor *E*-HFC-1234ze is part of that process either.

- 3.7 The subject-matter of claim 1 and of claim 2, which is dependent on claim 1, meets the requirements of Article 56 EPC.

First to eighth auxiliary requests

4. Since the main request is allowable, the auxiliary requests need not be discussed.

## Order

### For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the opposition division with the order to maintain the patent in amended form on the basis of the claims of the main request (filed as the first auxiliary request with the statement setting out the grounds of appeal) and a description to be adapted accordingly.

The Registrar:

The Chairwoman:



C. Vodz

O. Loizou

Decision electronically authenticated