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# Datasheet for the decision of 12 December 2025

**Case Number:** T 0159/25 - 3.3.09

**Application Number:** 12178209.8

**Publication Number:** 2546225

**IPC:** C07C17/087, C07C21/19, C09K5/00

**Language of the proceedings:** EN

**Title of invention:**
Method for producing fluorinated organic compounds

**Patent Proprietor:**
Solstice Advanced Materials US, Inc.

**Opponents:**
ARKEMA FRANCE (opposition withdrawn on 19 January 2023)
Zhejiang Huanxin Fluoro Material Co., Ltd.
Sino-Resource Imp. & Exp. Co., Ltd.

**Headword:**
Fluirinated compounds/HONEYWELL

**Relevant legal provisions:**
EPC Art. 100(a), 56, 100(c)
RPBA 2020 Art. 12(2), 12(6)

**Keyword:**
Main request: inventive step - (yes); added subject-matter - (no)

**Decisions cited:**
T 2458/17, T 2712/19

**Catchword:**

Europäisches Patentamt
European Patent Office
Office européen des brevets

**Beschwerdekammern**

**Boards of Appeal**

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**Case Number: T 0159/25 - 3.3.09**

# D E C I S I O N
# of Technical Board of Appeal 3.3.09
# of 12 December 2025

| | |
|---|---|
| **Appellant:** (Opponent 2) | Zhejiang Huanxin Fluoro Material Co., Ltd.<br>Yanggongwan, Huajie Town<br>Yongkang City<br>Zhejiang 321302 (CN) |
| **Representative:** | Carpmaels & Ransford LLP<br>One Southampton Row<br>London WC1B 5HA (GB) |
| **Appellant:** (Opponent 3) | Sino-Resource Imp. & Exp. Co., Ltd.<br>FL9, Wenhua Mansion No. 488 Zhenming Road<br>Ningbo, Zhejiang 315010 (CN) |
| **Representative:** | Cohausz & Florack<br>Patent- & Rechtsanwälte<br>Partnerschaftsgesellschaft mbB<br>Bleichstraße 14<br>40211 Düsseldorf (DE) |
| **Respondent:** (Patent Proprietor) | Solstice Advanced Materials US, Inc.<br>251 Little Falls Drive<br>Wilmington, DE 19808 (US) |
| **Representative:** | Crooks, Elizabeth Caroline<br>Kilburn & Strode LLP<br>Lacon London<br>84 Theobalds Road<br>London WC1X 8NL (GB) |
| **Decision under appeal:** | **Decision of the Opposition Division of the European Patent Office posted on 10 December 2024 rejecting the opposition filed against European patent No. 2546225 pursuant to Article 101(2) EPC.** |

**Composition of the Board:**

| | |
|---|---|
| **Chairman** | A. Haderlein |
| **Members:** | A. Veronese |
| | R. Romandini |

## Summary of Facts and Submissions

I. Appeals were filed by interveners/opponents 2 and 3 (hereinafter: appellants 2 and 3) against the opposition division's decision to reject the opposition and the interventions filed against the European patent. Opponent 1's opposition had been withdrawn.

II. Claims 1 and 4 to 6 of the opposed patent read:

"*1. A method for producing fluorinated organic compounds comprising converting a compound of Formula (IAA)*

CH2=CClCF3 (IAA)

*to a compound of Formula (IB)*

*CH3CClFCF3 (IB)*

*and dehydrohalogenating said compound of Formula (IB) to form a compound of Formula (II)*

*CFCF=CH2 (II)*"

"*4. A method according to claim 1, wherein the conversion of a Formula (IAA) compound to a Formula (IB) compound comprises a liquid phase reaction.*"

"*5. A method according to claim 4, wherein the conversion of a Formula (IAA) compound to a Formula (IB) compound comprises a catalytic liquid phase reaction.*"

"*6. A method according to claim 4, wherein the conversion of a Formula (IAA) compound to a Formula*

*(IB) compound comprises a non-catalytic liquid phase reaction.*"

III. In their notices of opposition and intervention, opponent 1 and interveners/opponents 2 and 3 requested that the patent be revoked in its entirety on the grounds under Article 100(a) (lack of inventive step) and (c) EPC.

IV. The documents submitted during the opposition proceedings included:

D2: WO 2005/012212 A2

D5: M.O. Burgin et al., J. Phys. Chem., 2001, vol. 105, p. 1615-1621

D10: US 2,495,407

D11: A.L. Henne et al., J. Am. Chem. Soc., 1946, vol. 68, p. 496-497

D17: EP 0 939 071 A1

D27: L. Zhu et al., J. Phys. Chem. A, 2005, vol. 110, No. 4, p. 1506-1517, published online on 19 October 2005

D28: E.T. McBee et al., Industrial and Engineering Chemistry, 1947, vol. 39, No. 3, p. 418-420

D29: E.T. McBee et al., Fluorinated Derivatives of Propane, 1947, vol. 69, p. 944f

D35: Xing Qiyi et al., Basic Organic Chemistry, Higher Education Press (2005), Ed. 3

D35': Translation of D35

D36: K. Teinz et al., Environmental, 2015, vol. 165, p. 200-208

D75: J.L. Webb et al., J. Org. Chem. 1973, vol. 38, No. 11, p. 2091

D77: Declaration of Prof. Pei Jian

V. In its decision, the opposition division found *inter alia* the following.

- The claims of the patent as granted had a basis in the application as filed.

- The claimed method involved an inventive step starting from any of D1, D5 or D27 as the closest prior art. The claimed method differed from that disclosed in these documents on account of the first step, in which compound 1233xf (IAA) was converted to compound 244bb (IB). The underlying problem was providing an alternative method for producing compound 1234yf (II). Neither D1, D5 or D27 nor the secondary documents D17, D35, D43 and D75 taught towards the claimed solution.

VI. The appellants' arguments are summarised as follows.

- The claimed method did not involve an inventive step starting from D27 as the closest prior art. While the second step of claim 1, in which the intermediate compound 244bb was converted to 1234yf, was disclosed in D27, the first step, i.e. the conversion of 1233xf to 244bb, was not. The underlying problem was providing an alternative synthetic method for producing 1234yf. Starting from D27 and faced with this problem, the skilled person would have been prompted by D2, D10, D17, D35 and D75 to carry out the claimed synthetic steps and would have arrived at the claimed solution.

- The skilled person would have searched for alternative methods for preparing the intermediate compound 244bb and would have taken into account

the teaching of D2. In doing so, they would have considered adding hydrogen fluoride (hereinafter: HF) to 1233xf. Compound 1233xf was the only propene which could react with HF to produce 244bb. The conclusions reached by the board in the earlier cases T 2458/17 and T 2712/19 were not applicable to the case in hand.

- The subject-matter of claims 1 and 4 to 6 extended beyond the content of the application as filed.

VII. The arguments of the patent proprietor (hereinafter: respondent) are summarised as follows.

- The claimed method involved an inventive step. D11 was the closest prior art, not D27. Even if D27 were considered the starting point, the claimed method was not obvious. Starting from D27, the distinguishing features were the claimed method steps. The problem was providing a method which could be implemented on an industrial scale. The skilled person faced with this problem would not have found an incentive to carry out the claimed method in any of the prior-art documents. The cited documents, in particular D2, did not provide a pointer towards the claimed solution. A similar conclusion had already been reached in the earlier cases T 2458/17 and T 2712/19. Even if the skilled person had turned to D2, they would have prepared the intermediate 244eb rather than 244bb. The appellants' arguments relied on hindsight.

- The same conclusions applied starting from D11, which disclosed a substantially different method.

- The subject-matter of the claims did not extend beyond the content of the application as filed.

***The requests***

VIII. The appellants 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 patent be maintained on the basis of one of auxiliary requests 1 to 7, filed with the reply to the statements setting out the grounds of appeal.

## Reasons for the Decision

1. *Inventive step*

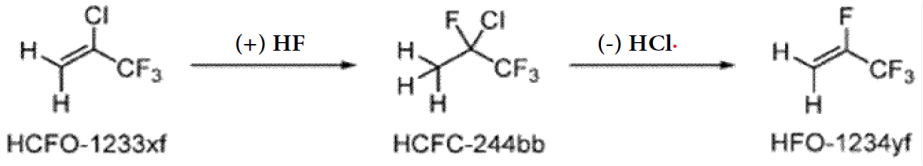
1.1 Claim 1 relates to a method for producing a fluorinated organic compound which can be used and commercialised, for example, as a refrigerant, fire extinguishing agent, heat transfer medium and propellant. The method comprises the steps of:

- adding HF to a compound of formula $CH_2=CClCF_3$ ((IAA) or "HCFO-1233xf"; hereinafter: "1233xf") to form

- a compound of formula $CH_3CClFCF_3$ ((IB) or "HCFC-244bb"; hereinafter: "244bb"), and

- dehydrochlorinating 244bb to form a compound of formula $CF_3CF=CH_2$ (compound (II) or "HFO-1234yf"; hereinafter: "1234yf")

1.2 The steps of this method are outlined below:




1.3 The appellants contested the opposition division's finding that the claimed method involved an inventive step over the teaching of the cited prior-art documents.

*Closest prior art*

1.4 The appellants argued that D27 disclosed the following reactions, which were induced by UV photolysis of $CFIClCH_3$ and $CH_3I$:

(i) $CFIClCF_3 + CH_3I$ ---> 244bb and
(ii) 244bb ---> 1234yf + HCl

1.5 In their opinion, since D27 disclosed the second step of the claimed method and the formation of 1234yf, i.e. the end product of that method, this document represented the closest prior art.

1.6 The respondent contested this view, arguing that D27 was not the closest prior art because the described method was carried out using micromolar amounts of reactants, at very low pressure. These working conditions could not be scaled up to provide a commercially viable method, unlike the method disclosed in the opposed patent. By contrast, D11 disclosed a method for preparing 1234yf which was not inherently limited by its chemistry to conditions preventing it from being scaled up to a commercially viable method.

Consequently, it was D11 and not D27 that was the closest prior art and the only suitable starting point for assessing inventive step.

1.7 The respondent's arguments are not persuasive. Although D27 focuses on understanding the mechanisms underpinning certain reactions on a micromolar scale, the reactions lead to the formation of an excited form of 244bb, i.e. the intermediate of the claimed method, and of 1234yf, the end product. Since the development of a commercially viable process can start from reactions on a very small scale, D27 can be considered a suitable starting point.

1.8 Furthermore, D11, a scientific paper published long before the filing date, provides only limited information on the reaction conditions and the amounts of materials used. The method described in D11 contains multiple steps, some of which proceed "very slowly" and with low yields. Accordingly, the disclosure of D11 does not disqualify D27 as the closest prior art and a suitable starting point for assessing inventive step.

1.9 During the opposition proceedings, the appellants considered D1 and D5 as alternative starting points. However, during the appeal proceedings, they conceded that the teaching of D1 and D5 did not extend beyond that of D27 and limited their arguments to this document as the sole starting point. Consequently, only D27 will be considered as the closest prior art in the following inventive step assessment.

*Distinguishing features*

1.10 The claimed method differs from that disclosed in D27 in that it includes two synthetic steps:

- a first synthetic step requiring the formation of 244bb by adding HF to 1233xf, rather than from a radical reaction between $CFIClCF_3$ and $CH_3I$ induced by UV photolysis

- a second synthetic step in which 244bb is dehydrogenated to 1234yl

1.11 The appellants did not dispute that D27 did not disclose the first step. With regard to the second step, they submitted that although D27 did not disclose isolating 244bb and using it in a second separate dehydrogenation step, the formation of 244bb and its dehydrohalogenation to 1234yf were inherently disclosed. D27 taught that 244bb was formed by a photolytic radical reaction between $CFIClCF_3$ and $CH_3I$ and that it subsequently underwent a unimolecular elimination of hydrogen chloride (hereinafter: HCl), leading to the formation of 1234yf. Claim 1 did not require 244bb to be isolated or exclude the possibility that 244bb was formed in an excited state with concomitant loss of HCl. Accordingly, D27 disclosed the second step of the claimed process.

1.12 The board does not agree. From the wording of claim 1, namely a method for "converting a compound of Formula (IAA) to a compound of Formula (IB)" and "dehydrogenating said compound of Formula (IB) to form a compound of Formula (II)" (emphasis added), the skilled person would understand that this claim defines independent and distinguishable synthetic steps. This implies that the working conditions are changed after the first step, in order to promote the second step. This conclusion applies irrespectively of whether the compound of formula (IB) (244bb) is isolated and/or

purified after the first step. Consulting the description confirms that the first and the second step of the claimed method are separate synthetic steps carried out under different working conditions (see paragraphs [0022] to [0040] and the examples).

1.13 D27 discloses the formation of an excited form of 244bb which spontaneously undergoes a dehalogenation step with loss of HF or HCl. The transformation of this transient excited form of 244bb does not require this compound to be isolated or the reacting conditions to be altered. There is a difference between the two-step synthetic method of claim 1 and the one-pot, one-step synthetic method leading directly to HFO-1234yf described in D27. Consequently, D27 does not disclose the second synthetic step of the claimed method.

*Technical effect*

1.14 According to the respondent, the claimed reaction steps allowed 1234yf production to be scaled up to levels exceeding those attainable using the process of D27.

1.15 D27 is a scientific article focusing on the mechanisms of certain reactions of specific activated compounds, namely 244bb and its deuterated isotopes, obtained by the radical combination of two halogenated starting materials, $CFIClCF_3$ and $CH_3I$. The radical reaction is induced by UV photolysis on a few micromoles (corresponding to around 200 micrograms) of starting materials, under vacuum, in a vacuum line (see page 1507, right-hand column). As explained on page 1508, left-hand column, the yield of the decomposition to 1234yf drops to zero at higher pressures. It was not disputed that the required experimental set-up for the

method described in D27 meant that it could not be scaled up to produce larger amounts of the product.

1.16 The claimed method does not require the experimental set-up used in the study of D27. The examples in the opposed patent demonstrate that several hundred grams of starting materials can be mixed and subjected to simple heating steps, without the need to create a vacuum.

1.17 The appellants argued that claim 1 did not specify the reaction conditions or the requirement to add a catalyst in order to carry out the claimed steps within a reasonable time and with high yield and selectivity. The tests in the patent indicated that the catalyst had a significant impact on the reaction yields and that, under certain conditions, the overall yield of the method was as low as 5.6%. Moreover, D36 (which was not part of the state of the art) showed that, if not catalysed, the conversion of 244bb to 1234yl could be less than 1%. Accordingly, in the appellants' opinion, the claimed method could not be scaled up to an industrial scale and be "commercially viable" across the entire scope of claim 1.

1.18 These arguments are not convincing. Even though the overall yield of the claimed method might be low under certain conditions, the tests in the patent make it credible that the method can be carried out and produce higher amounts of 1234yl than those described in D27 – and without the experimental set-up described in that document. With regard to D36, the observed low conversion rate was noted after reaction times of a few seconds. Such short reaction times are certainly not those used to carry out a synthetic step in an industrial reactor.

1.19 For these reasons, it is credible, as submitted by the respondent, that the claimed reaction steps allow the reaction to be carried out and potentially scaled up beyond what can be achieved by implementing the process of D27 – and without using the experimental set-up described in that document.

*Underlying objective technical problem*

1.20 Relying on their position that the claimed method was not suitable for being scaled up and was therefore not "commercially viable" across the entire claimed scope, the appellants argued that, starting from D27, the underlying problem was merely providing an alternative method for producing 1234yf.

1.21 The board considers that, taking into account the aforementioned conclusions in point 1.19, the objective technical problem could be formulated as providing an improved method for producing 1234yf which can be scaled up on an industrial scale and be "commercially viable".

1.22 However, for the sake of argument and in the appellants' favour, it will be assumed in the following that the underlying objective technical problem is providing an alternative method for producing 1234yf.

*Non-obviousness of the claimed solution*

1.23 The appellants argued that, starting from D27 and faced with the underlying problem, the skilled person would have been prompted by the prior art, in particular D17, D2 and D75, to provide an alternative method for producing 1234yf. In their view, in relying on the

teaching of these documents, the skilled person would first have produced the intermediate compound 244bb by adding HF to 1233xf and then dehydrochlorinated 244bb, in line with the teaching of D27, thus arriving at the proposed method without an inventive step.

1.24 These arguments are not convincing.

1.25 D27 focuses on determining the rate constants and kinetic isotopic effects when eliminating HCl and HF from activated 244bb. Remarkably, however, rather than starting from 244bb – a compound which was already part of the state of the art (as shown by D29) – the authors of D27 decided to induce the formation of an excited form of 244bb by means of a procedure that involved radical chemistry and required a special experimental set-up involving UV irradiation under vacuum.

1.26 The appellants noted that, in a concluding remark in D27, the authors mentioned the possibility of verifying the observed results by thermal activation experiments using 244bb (see page 1516, "Conclusions"). However, the authors did not perform any such experiments, instead relying on the aforementioned radical reactions to produce an excited form of 244bb and study its transformation into 1234yf. During the oral proceedings, appellant 2 suggested that this choice could have been made due to previous experience in radical chemistry.

1.27 This argument is not persuasive. It is in fact more reasonable to believe that specific technical considerations played a role when selecting a synthetic path and an experimental set-up which lead to the formation of the excited unstable form of 244bb described in D27.

1.28 As observed by the respondent, in order to arrive at the claimed synthetic method, the skilled person would have had to completely abandon the chemistry described in D27 and design a new synthetic method from scratch, using different starting materials, a different reaction pathway and a substantially different type of chemistry.

1.29 It is thus logical to assume that, rather than designing a completely new reaction pathway, a skilled person searching for an alternative method for producing 1234yf would have attempted to modify the reaction conditions described in D27, for example by finding conditions under which a vacuum line could be dispensed with. As suggested by the respondent, the skilled person would, for example, have attempted to replace the mercury iodine scavenger, adjusted the reaction temperature or used different iodinated materials suitable for generating, as an alternative to 244bb, other radicals and intermediates that could subsequently be converted to 1234yf.

1.30 For these reasons, the skilled person would not have had any incentive to consult documents relating to substantially different reaction pathways and types of chemistry. Furthermore, as explained below, even if the skilled person had taken into account the teaching of the secondary prior-art documents mentioned by the appellants (D17, D35, D2, D75 and D10), they would not have arrived at the claimed method in an obvious manner.

D27 in combination with D17 and D35 (D35')

1.31 The appellants argued that the claimed method did not involve an inventive step over a combination of the teaching of D27 with that of D17 and D35 (see D35', the English translation of D35). In their opinion, D17 disclosed the preparation of 244bb starting from 1233xf, i.e. the first step of the claimed method. Thus, the skilled person would have conducted the first step of the claimed method to produce the intermediate 244bb, following the teaching of D17, and then dehydrochlorinated 244bb to obtain 1234yf, following the teaching of D27.

1.32 This argument is not convincing. First, when starting from D27, which relates to a one-step process involving radical reactions and a transient unstable reaction intermediate, the skilled person would not have necessarily looked into methods involving two separate synthetic steps. Furthermore, contrary to the appellants' submissions, D17 does not disclose the first step of the claimed method.

1.33 D17 discloses a process for preparing a fluorinated propane by contacting a fluorinated propene with HF in the gas phase. The reaction can be carried out on an industrial scale; see paragraphs [0006] to [0008], [0018] and [0019]. Among other exemplified fluorinated propenes, D17 mentions 1233xf (see 2-chloro-3,3,3-trifluoropropene in paragraph [0018]). However, D17 does not disclose, for each of the listed fluorinated propenes, the fluorinated propane products obtained upon contact with HF. In particular, it does not indicate the product obtained starting from 1233xf. Instead, D17 defines the obtained fluorinated propane products by means of the generic formula:

$C(Z^1)_3$-$CH(Z^2)$-$CF(Z^3)_2$

This does not encompass compound 244bb (see paragraphs [0019] and [0020] and in particular column 6, lines 3 to 7).

1.34 Looking at the aforementioned formula, the skilled person would expect that contacting 1233xf with HF would produce 244db, not 244bb, the claimed intermediate product. Paragraph [0020] of D17 provides a list of examples of specific fluorinated propane products obtained by hydrofluorination. Yet, this list does not include 244bb. Thus, D17 does not provide any incentive to obtain 244bb from 1233xf.

1.35 The appellants argued that the disclosure of paragraph [0019] did not necessarily imply that adding HF to any propene of formula $C(Z^1)_3$-$C(Z^2)$=$C(Z^3)_2$ would result in a propane of formula $C(Z^1)_3$-$CH(Z^2)$-$CF(Z^3)_2$. In this context, the appellants mentioned the reaction of 2-fluoropropene with HF (unsupported by evidence) and the reaction of 2-chloropropene with HF (described in D75), which allegedly resulted in the fluorine atom being added to the C-2 atom of the propene. They also speculated that the reaction scheme in paragraph [0019] related only to reactions of HF with the vinylene-containing propenes of D17, i.e. propenes containing a (-CH=CH-) moiety.

1.36 These arguments are not convincing either. As countered by the respondent, the skilled person would not consider the reaction schemes described in paragraphs [0018] and [0019] of D17 to be limited exclusively to vinylene-containing propenes. Rather, the skilled person would consider these paragraphs particularly

relevant for the compounds they explicitly mention, including 1233xf. This is irrespective of the reactivity of 2-fluoropropene and 2-chloropropene, which are neither mentioned in D17 nor fall under its reaction schemes.

1.37 The appellants also noted that, according to the first sentence of paragraph [0019], the type of fluorinated propane obtained in the hydrofluorination reaction described in paragraphs [0018] and [0019] depended on the type of propene used. The skilled person would have relied on common general knowledge to predict the reaction product. In this context, the appellants referred to D35', the English translation of D35, an organic chemistry textbook outlining Markovnikov's rule. In their opinion, in relying on the teaching of D35', the skilled person would have expected the addition of HF to 1233xf, described in D17, to lead to the Markovnikov addition product, namely 244bb.

1.38 According to Markovnikov's rule, when an HX (where X is a halogen) is added to an alkene, the hydrogen of the HX adds to the double-bond carbon having more hydrogen atoms, because this results in the most stable carbocation being formed (see pages 319 and 320 of D35'). D35' further explains that if there is an electron-withdrawing group, such as $CF_3$- on a double-bond carbon, the opposite occurs, and the so-called anti-Markovnikov product is formed. Furthermore, D35' teaches that if a halogen is present on a double-bond carbon, the reaction still follows Markovnikov's rule. This is because although the halogen is an electron-attractor, its lone electron pairs stabilise the carbocation by conjugation. The conjugation effect of the halogen prevails over the electron-withdrawing effect, and the Markovnikov product is formed.

1.39 The appellants submitted that according to the teaching of page 320 of D35', when both a halogen and a $CF_3$- group are present on the carbon of a double bond, the conjugation effect induced by the halogen prevails over the electron-attractor effect of the $CF_3$- group, leading again to the Markovnikov product. Thus, in their opinion, it was to be expected that the addition of HF to 1233xf as described in D17 led to 244bb, the Markovnikov addition product, rather than to 244db, the anti-Markovnikov product.

1.40 This interpretation of the teaching of D35' is incorrect. As pointed out by the respondent, D35' is silent on the net effect of having both a Cl- and a $CF_3$- group attached to a carbon of a double bond. The passage on page 320, discussing the effect of lone electron pairs in atoms such as O, N and halogens, relates to situations in which these atoms are the sole substituents on the double-bond carbon. In these cases, the electro-donating conjugation effect of the lone electron pair – present for example on a chlorine atom – prevails over the electron-withdrawing effect induced by that same chlorine atom. This is confirmed by the figures on page 320 of D35', showing the reaction of HCl to chloroethane, an alkene containing only a chlorine atom attached to a carbon of the double bond.

1.41 With their statements setting out the grounds of appeal, the appellants filed D77, an expert opinion discussing the teaching of D35'. They argued that D77 was being filed on appeal to address the allegedly incomplete analysis by the opposition division of the impact of the effect of both a Cl- and a $CF_3$- group in 1233xf. In their opinion, D77 merely explained the

teaching of D35' and did not contain additional technical information.

1.42 However, this is plainly not the case. Although paragraphs 4 to 9 of D77 generally discuss the content of D35', paragraphs 10 and 11 consider the scenario where both an electron-withdrawing group (e.g. a $CF_3$-group) and a halogen atom are present on the same carbon atom of a double bond, which is not discussed in D35'. D77 then goes on to consider the specific case of the addition of HF to 1233xf, which is not discussed in D35' either. Consequently, D77 does not merely explain the teaching of D35'; it goes far beyond it.

1.43 Since D77 was drafted 19 years after the filing date by an expert having knowledge and abilities that far exceed those of the skilled person at the filing date, D77 cannot be considered a document representing the common general knowledge at the filing date either.

1.44 The respondent requested that D77, filed with the appellants' statements setting out the grounds of appeal, not be admitted into the appeal proceedings. This request is well founded. In a letter filed during the opposition proceedings, the respondent had already argued that the substitution does not necessarily follow Markovnikov's rule when both Cl- and the $CF_3$-group are present on the same carbon atom of a double bond. Furthermore, appellant 2 was already in possession of D77 during the opposition proceedings, since it had filed this document during the opposition proceedings relating to a parallel case. Thus, D77 could and should have already been filed during the opposition proceedings.

1.45 In so far as D77 repeats the teaching of D35', it does not contain relevant information. Nor does it contain relevant information in so far as it goes beyond that teaching, because it does not represent the common general knowledge at the filing date. For these reasons, D77 is not admitted into the appeal proceedings (Article 12(2) and (6) RPBA).

1.46 The appellants also argued that at least some of the Markovnikov product would have been formed by adding HF to 1233xf, because a mixture of the two possible products was necessarily formed. However, there is no basis for this speculation. In fact, as shown e.g. in D28, adding HCl to CH3CF2CH=CH2 results exclusively in the formation of CH3CF2CH2CH2Cl.

1.47 For these reasons, it is concluded that the teaching of D17, whether alone or in combination with that of D35', does not give the skilled person starting from D27 an incentive to prepare 244bb from 1233xf and to convert 244bb to 1234yf.

D27 in combination with D2

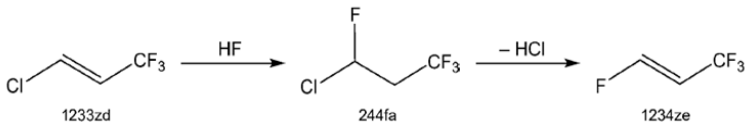
1.48 According to the appellants, when starting from D27 and seeking alternative processes for preparing 1234xf, the skilled person would have consulted further documents describing reactions of halogenated compounds similar to those claimed. There was no reason to limit the skilled person's horizon to literature describing 1234yl and 244bb when looking for an alternative to the process of D27. When consulting further documents, the skilled person would have taken into account the teaching of D2.

1.49 Claims 1 and 22 of D2 describe a process in which:

- HF is added to 1-chloro-3,3,3-trifluoropropene (1233zd) to form, as the intermediate, 1-chloro-1,3,3,3-tetrafluoropropane (244fa) and/or 1,1,1,3,3-pentafluoropropane (245fa), and

- the intermediate compound is dehydrochlorinated (in the case of 244fa) or dehydrofluorinated (in the case of 245fa) to form 1,3,3,3-tetrafluoropropene (1234ze)

1.50 In so far as the intermediate compound 244fa is formed, the reaction pathway is the following:




1.51 The appellants referred in particular to claim 22 of D2, which describes a dehydrochlorination step conducted by thermal decomposition. In their opinion, although the intermediate and the end compound of the method of D2 differed from those claimed, the skilled person would have appreciated that the chemistry of D2 could be applied to prepare the claimed compound 1234yf.

1.52 In their view, since compound 244bb was already disclosed in D27 as an intermediate for producing 1234yf, D2 would have prompted the skilled person to start the synthesis from 1233xf. This was the only propene that could be reacted with HF to form 244bb. The patent, as well as other prior-art documents, taught that compounds 244bb and D244fa were closely related and often referred to together as regioisomers.

1.53 Thus, when seeking an alternative method for preparing 1234yf, the skilled person would have provided the claimed method without exercising an inventive step.

1.54 These arguments are not convincing.

1.55 As already explained when dealing with the combination of D27 and D17, the skilled person starting from the one-step radical reaction process described in D27 would not have relied on documents involving the use of substantially different compounds and chemical reactions.

1.56 Even if the skilled person had consulted D2, they would not have attempted to prepare 244bb by adding HF to 1233xf and subsequently dehydrochlorinating 244bb to form 1234yf merely because of an apparent structural similarity between the intermediate compounds. As noted by the respondent, the intermediate compound 244fa of D2 differs considerably from 244bb, not only on account of the position of the fluorine atom but also on account of the position of the chlorine atom; see the structures of 244fa and 244bb shown below:


1.57 Relocating both the F and the Cl atoms would thus have been necessary. The second modification is not explained by the difference between 1234ze and 1234yl and is only proposed with hindsight. Taking into account the teaching of D2 and seeking an alternative synthetic method for producing 1234yf, the skilled person would have considered preparing a different

intermediate compound, namely 244eb, rather than 244bb as defined in the claim; see the respective structures below:


1.58 The skilled person would have then dehydrochlorinated 244eb, rather than 244bb, to arrive at 1234yf. Thus, they would not have carried out the claimed method.

1.59 The appellants argued that since D27 already disclosed 244bb, the skilled person would have looked for further methods to produce this same intermediate while relying on the chemistry disclosed in D2.

1.60 This argument is not persuasive either. First, once the skilled person had decided to abandon the radical reaction chemistry of D27, there would have been no special reason to find an alternative route passing through the intermediate compound 244bb. Furthermore, even if the skilled person had decided to prepare 244bb, they would have had reasons to doubt that 1233xf was a suitable starting point. That is because, for the reasons already set out when discussing the teaching of D17 and D35', the skilled person would have expected the addition of HF to 1233xf to lead to the formation of the anti-Markovnikov compound 244db rather than the desired Markovnikov product 244bb.

1.61 Moreover, as noted during the oral proceedings before the board, claim 22 and the table on page 12 of D2 indicate that the addition of HF to 1-chloro-3,3,3-trifluoropropene (1233zd) leads to the formation not only of 1-chloro-1,3,3,3-tetrafluoropropane (244fa) but

also of 1,1,1,3,3-pentafluoropropane (245fa), in that the chlorine atom is replaced by a fluorine and a fully fluorinated compound is formed. In view of this teaching, the skilled person would have had additional reasons to doubt that the addition of HF to 1233xf, which contains both a $CF_3$- group and a chlorine atom on the same double-bond carbon, results in the formation of 244bb. The formation of the fully fluorinated compound could also be expected.

1.62 Consequently, the appellants' argument that a person skilled in hydrochlorofluorocarbon chemistry would have considered the intermediates 244bb and 244fa to be "closely related exchangeable alternatives" and would have provided the claimed method without the need for an inventive step by combining the teaching of D27 and D2 is not convincing.

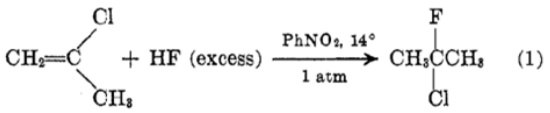
1.63 During the appeal proceedings, the respondent argued that the findings of the board in two earlier cases (T 2458/17 and T 2712/19) confirmed that the claimed subject-matter involved an inventive step over D27 and D2. The appellants disputed this view. This board considers that, taking into account the above analysis of the teaching of the cited documents and the conclusions reached, there is no need to decide whether the findings in those decisions confirm the board's conclusions above.

D27 in combination with D75 (or D10)

1.64 According to appellant 3, starting from D27 and faced with the problem of providing an alternative method for preparing 1234yf, the skilled person would have also been prompted by D75 (and D10) to add HF to 1233xf to

form 244bb, and to then dehydrochlorinate 244bb to produce 1234yf.

1.65 D75 (and D10) teaches that adding HF to 2-chloropropene yields 2-chloro-2-fluoro-propane. The reaction described in D75 is the following:




1.66 According to appellant 3, by applying the same chemistry and taking into account the common general knowledge represented by D35', the skilled person would have expected the addition of HF to 1233xf to result in the formation of 244bb. Consequently, no inventive step was involved in this step.

1.67 These arguments are not convincing.

1.68 Appellant 3's key argument is that the skilled person would have expected that $CH_3CFClCF_3$ could be produced by using the method for producing $CH_3CFClCH_3$ described in D75 and D10. However, this argument completely ignores the effect of the $CF_3$- group on the direction of HF addition to the double bond, which has already been discussed above when dealing with D17. The skilled person would have known that the presence of the electron-withdrawing $CF_3$- group would likely have led to the formation of the anti-Markovnikov product 244db, rather than 244bb. As discussed above, this is also the teaching of D17. The formation of a fully fluorinated compound could not be ruled out either, as discussed above when dealing with D22.

1.69 Consequently, the combination of D27 with D75 (or D10) does not render the claimed method obvious.

Conclusions on non-obviousness

1.70 The above analysis of the cited prior-art documents shows that in order to arrive at the claimed method starting from D27, the skilled person faced with the underlying problem would have had to:

- completely abandon the chemistry of D27

- develop a new synthetic method from scratch, involving substantially different synthetic steps, compounds and chemical reactions from those used in D27

1.71 Furthermore, the analysis of those documents shows the following.

- None of the secondary documents cited by the appellants provides a valid pointer towards providing the claimed alternative method for preparing 1234yf.

- It would not have been obvious, on the basis of the teachings of those documents, to develop the claimed method for converting 1233ff to 244bb.

1.72 As stated by the respondent, rather than providing the claimed method, the skilled person faced with the problem would have:

- tried to modify the experimental set-up and the operating conditions used to carry out the experiments described in D27 or, alternatively,

- turned to prior-art documents which disclose known synthetic methods for preparing the intermediate compound 244bb (D29) and/or the final product 1234yf of the claimed method (D11)

1.73 The respondent provided arguments why, when starting from D11 or D29, the skilled person would not have arrived at the claimed solution. The appellants did not contest these arguments.

1.74 For these reasons, it is concluded that, as already decided by the opposition division, the claimed method involves an inventive step over the cited prior-art documents (Article 56 EPC).

2. *Amendments*

2.1 The appellants contested the opposition division's finding that page 4 of the application for the opposed patent and of the parent application as filed provided the basis for the method defined in claim 1. They argued that claim 1 contained originally undisclosed subject-matter because it involved two arbitrary, unprompted selections from lists of alternative reaction pathways disclosed on pages 3 and 4 of the description of the applications as originally filed, namely:

- the selection of an indirect conversion, which was selected over an allegedly preferred direct conversion

- the selection of the reaction pathway disclosed on page 4, lines 7 to 14, over that on page 4, lines 4 to 7 of the applications as filed

2.2 These arguments are not persuasive.

2.3 Reading pages 3 and 4 of the description of the application for the patent and of the parent application as filed, it is readily apparent that the passage on page 4, lines 7 to 14 is the only one which identifies a reaction pathway indicating the specific reactant, intermediate compound and final product involved. This disclosure, which identifies the method of claim 1 as granted, clearly stands out from the otherwise generic teaching of pages 3 and 4 as filed. Reactions carried out using this pathway, and the relevant compounds, are also exemplified in the applications as filed in examples 5 and 6.

2.4 Thus, there is no need to make multiple selections among different lists of a certain length of enumerated embodiments to arrive at the claimed subject-matter. The claimed method is disclosed as such and stands out clearly in the aforementioned passage of the applications as filed. Thus, claim 1 does not create originally undisclosed subject-matter.

2.5 The appellants contended that claims 4 to 6 also contained subject-matter extending beyond the content of the applications as filed.

2.6 With regard to claims 4 and 5, the appellants argued that the step of fluorinating the compound of formula (IAA) to form the compound of formula (IB) in the liquid phase was not based on the teaching of page 9, lines 1 to 2 as filed. This was because certain passages of the applications as filed, in particular page 9, lines 12 to 15 and page 10, lines 1 to 2, stated that conversion in the gas phase was preferred

over that in the liquid phase. Thus, selecting the liquid conversion introduced added subject-matter. Claim 6 also created new subject-matter because it implied a selection of a non-catalytic conversion from the passage on claim 9, lines 1 to 6 as filed, in which catalytic conversions were preferred.

2.7 These arguments are not convincing.

2.8 First, the wording of the passages on pages 9 and 10 mentioned by the appellants does not specify that gas phase fluorination is preferred over liquid phase fluorination. The wording "*In preferred gas phase fluorination of Formula (IAA) compounds, the reaction is at least partially a catalyzed reaction ...*" on page 9, lines 12 to 15 discloses a preferred way of conducting the gas phase fluorination, but not that the fluorination in the gas phase is preferred as such.

2.9 Analogous conclusions apply to the sentence on page 10 reading: "*However, it is preferred in certain embodiments that this reaction step comprises a gas phase reaction ...*".

2.10 Furthermore, in view of the very limited number of alternatives disclosed in the passage on page 9, lines 1 to 6, no new subject-matter is created when providing the methods defined in claims 4 to 6. As far as claim 6 is concerned, although the claimed non-catalytic process appears to be less preferred than the catalytic one on page 9, lines 5 and 6, this is the only selection which needs to be made among the two options described in this passage. For these reasons, claims 4 to 6 do not create originally undisclosed subject-matter.

2.11 For these reasons, claims 1 and 4 to 6 do not contain subject-matter extending beyond the content of the application for the patent and the parent application as filed.

**Order**

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

The appeals are dismissed.

The Registrar: The Chairman:

K. Götz-Wein A. Haderlein

Decision electronically authenticated