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Datasheet for the decision of 9 June 2022

Case Number: T 1928/18 - 3.3.10

Application Number: 11705705.9

Publication Number: 2534120

IPC: C07C17/23, C07C21/18

Language of the proceedings: EN

Title of invention:
PROCESS FOR PRODUCING FLUORINE-CONTAINING ALKENE

Patent Proprietor:
Daikin Industries, Ltd.

Opponents:
ARKEMA France
Mexichem Fluor S.A. de C.V.

Headword:

Relevant legal provisions:
EPC Art. 100(a), 100(b), 100(c), 123(3)

Keyword:
Grounds for opposition - added subject-matter (no) - insufficiency of disclosure (no) - lack of patentability (no)
Amendments - broadening of claim (no)

Decisions cited:

Catchword:

Europäisches Patentamt
European Patent Office
Office européen des brevets

Beschwerdekammern

Boards of Appeal

Chambres de recours

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Case Number: T 1928/18 - 3.3.10

D E C I S I O N
of Technical Board of Appeal 3.3.10
of 9 June 2022

Appellant: (Opponent 1)	ARKEMA France 420 Rue d'Estienne d'Orves 92700 Colombes (FR)
Representative:	Arkema Patent Arkema France DRD-DPI 420, rue d'Estienne d'Orves 92705 Colombes Cedex (FR)
Respondent: (Patent Proprietor)	Daikin Industries, Ltd. Umeda Center Building 4-12, Nakazaki-Nishi 2-chome Kita-ku Osaka-shi Osaka 530-8323 (JP)
Representative:	Hoffmann Eitle Patent- und Rechtsanwälte PartmbB Arabellastraße 30 81925 München (DE)
Party as of right: (Opponent 2)	Mexichem Fluor S.A. de C.V. Eje 106 (sin número) Zona Industrial C.P. 78395 San Luis Potosi, S.L.P. (MX)
Representative:	Potter Clarkson The Belgrave Centre Talbot Street Nottingham NG1 5GG (GB)
Decision under appeal:	**Interlocutory decision of the Opposition Division of the European Patent Office posted on**

25 June 2018 concerning maintenance of the European Patent No. 2534120 in amended form.

Composition of the Board:

Chair	P. Gryczka
Members:	R. Pérez Carlón
	L. Basterreix

Summary of Facts and Submissions

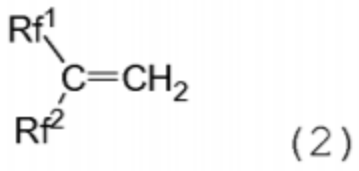
I. The appellant (opponent 1) lodged an appeal against the decision of the opposition division on the maintenance of European patent No. 2 534 120 in the form of the first auxiliary request.

II. Two notices 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 novelty and inventive step (Article 100(a) EPC).

III. Opponent 2, which is a party as of right, took no active part in these appeal proceedings. It informed the board that it would not be attending the oral proceedings, which took place on 9 June 2022.

IV. Claim 1 of the request found allowable by the opposition division, which is the main request of the respondent (patent proprietor) in these appeal proceedings, reads as follows:

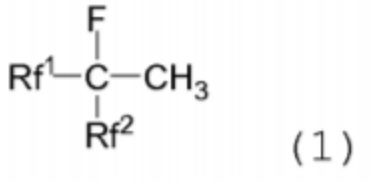
"A process for producing a compound of formula (2):



(2)

wherein Rf^1 and Rf^2 each individually are H, F or $X(CF_2)_n$- wherein n is an integer of 1-5 and X is F or H, with the proviso that Rf^1 and Rf^2 are not simultaneously H,

comprising heating a compound of formula (1) wherein Rf^1 and Rf^2 are as defined above:



(1)

in a gas phase in the presence of more than 50 mol anhydrous HF per mol of compound (1) to perform a dehydrofluorination reaction."

V. The documents filed include the following:

D1 WO 2009/125199 A2
D2 WO 2008/040969 A2
D3 WO 2007/054781 A1
D4 WO 2009/138764 A1
D12 "Material Safety Data Sheet: Hydrofluoric Acid, Anhydrous", Honeywell, January 2003
D13 "Hydrogen Fluoride, Anhydrous: Technical Data Sheet", Solvay, 2005-2014
D14 "Anhydrous Hydrogen Fluoride", Honeywell, 2014
D15 "HF Hydrogen fluoride", Solvay Fluor GmbH

VI. The opposition division concluded that claim 1 of the first auxiliary request found a basis in the combination of claim 1 as originally filed with page 5, lines 5-10 of the description. Claim 5 found a basis in claim 5 as originally filed combined with page 5, lines 5-10 and in claim 1 as originally filed in combination with page 5, lines 5-10 and lines 18-20 of the original description.

It further concluded that the feature "anhydrous HF" was not unclear to an extent that the skilled person could not carry out the claimed invention, which was thus sufficiently disclosed.

The processes of the prior art neither required anhydrous HF nor more than 50 mol per mol of compound (1). The claimed process was thus novel.

Document D2 was the closest prior art. The problem underlying the claimed invention was to provide a process with enhanced selectivity towards compound (2). The claimed solution was characterised by requiring more than 50 mol anhydrous HF per mol of compound (1). The prior art taught no link between the relative amount of HF and selectivity, and the claimed solution was thus inventive.

VII. The arguments of the appellant-opponent were as follows.

Claim 1 required dehydrofluorination but not necessarily of compound (1). It was thus not limited to obtaining compound (2) from compound (1).

Claim 1 of the main request did not find the required basis in the application as originally filed. The feature "more than 50 mol anhydrous HF per mol of compound (1)" was only disclosed on page 5, lines 8-9. This passage disclosed this feature "in the reaction system" and required (1) to be the starting material; none of these limitations were, however, features of claim 1. The amendment to dependent claim 5 was not an obvious correction and extended the scope of protection conferred by the patent as granted. For all these reasons, the requirements of Article 123 EPC were not fulfilled.

The feature "anhydrous HF" was unclear to an extent that the claimed invention could not be put into

practice by a skilled person throughout the whole scope of the claimed subject-matter. It was thus not sufficiently disclosed.

The claimed process was not novel over the embodiment resulting from the combination of claim 1 with claims 17 to 20 of D1. It was also not novel over D2 as the combination of claims 1, 8, 13 and 17 with page 3, lines 4 to 5 disclosed all the features of claim 1. Lastly, it was not novel over example 5 of D3.

Example 2 of D2 was the closest prior art. It disclosed a relative amount of HF below that required by claim 1. Any effect shown by the examples of the patent could not be achieved by every embodiment of claim 1, in particular for every relative amount of HF and every starting material. The problem underlying the claimed invention could only be considered to provide an alternative process for producing (2). The claimed solution would have been obvious for a skilled person and was thus not inventive.

VIII. The respondent-patent proprietor argued as follows.

Even if not explicitly, claim 1 required the dehydrofluorination of compound (1). Thus, claim 1 found the required basis in the combination of claim 1 as originally filed and page 5, lines 8-9.

Regardless of whether the amendment to claim 5 could also have been a correction under Rule 139 EPC, it had a basis in page 5, lines 8-9. The scope of protection conferred by the patent as granted was defined by its broadest claim (claim 1) and was not modified by an amendment to its dependent claim 5.

Even if claim 1 did not define the residual amount of water in anhydrous HF, this product was commercially available before the filing date of the patent. The claimed invention could thus be carried out by a skilled person.

With the exception of requiring HF to be anhydrous, documents D1 and D2 disclosed all the features of claim 1. They did not, however, disclose them in combination. D10 proved that example 5 of D3 did not involve the dehydrofluorination of 245cb. Claim 1 was thus novel.

Example 2 of D2 was the closest prior art. The problem underlying the claimed invention was to provide a process to produce (2) from (1) with improved selectivity. The available data showed that the claimed solution, characterised by the relative amount of HF, credibly solved that problem. The prior art did not hint at that solution, which was thus inventive.

IX. The final requests of the parties were as follows.

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

- The respondent-patent proprietor requested that the appeal be dismissed or that the patent be maintained in the form of one of auxiliary requests 1 to 23, filed with a letter dated 8 September 2020.

  It also requested that the experimental evidence filed with the statement of grounds of appeal not be admitted into the proceedings.

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

Reasons for the Decision

1. The appeal is admissible.

2. The claimed invention

Claim 1 relates to a process for producing a compound of formula (2). The process comprises heating a compound of formula (1), in a gas phase, in the presence of more than 50 mol anhydrous HF per mol of compound (1). Claim 1 requires a dehydrofluorination step.

Claim 1 does not explicitly require compound (2) to arise from the dehydrofluorination of (1).

The parties were divided on whether claim 1 implicitly required compound (2) to be obtained from compound (1).

Having regard to the type of reaction involved (dehydrofluorination) and the chemical nature of the compounds involved, the skilled reader would consider claim 1 to require the dehydrofluorination of compound (1) into compound (2). Any other reading of the claim would be contrived. The following examination of the case assumes this reading of claim 1.

3. Amendments

3.1 Claim 1 of the main request corresponds to claim 1 of the application as originally filed amended to require a relative amount of anhydrous HF of "more than 50 mol" per mol of compound (1).

It was undisputed that the application as originally filed discloses only once the relative amount of HF required by claim 1: on page 5, lines 8-9.

3.2 The appellant-opponent argued that the relative amount "50 mol or more" was disclosed in combination with two further restrictions which were not features of claim 1. On the one hand, the relative amount was required "in the reaction system". On the other, compound (1) was the starting material of the reaction.

3.3 The appellant-opponent argued that the reaction system could contain a recycling loop, which was a larger entity than a reactor. Not requiring the relative amount of HF to be achieved "in the reaction system" provided information not originally disclosed in the application as filed.

Claim 1 requires the dehydrofluorination reaction to be carried out in the presence of a defined relative amount of HF. This amount can only be present "in the reaction system". The board fails to see what new information is provided by the amendment to claim 1 in this respect which was not available in the application as originally filed.

3.4 Claim 1 relates to the synthesis of compound (2) from compound (1) by dehydrofluorination. Any other reading of the claim is artificial. Since the skilled reader would have inevitably considered compound (1) to be the starting material of the claimed process (see point 2 above), claim 1 does not add any subject-matter not originally disclosed in the patent application.

3.5 Claim 1 thus finds the required basis in the combination of claim 1 as originally filed and page 5, lines 8-9 of the description.

3.6 The relative amount of HF in claim 5 of the patent as granted was required with respect to compound (2). Claim 5 of the main request requires that relative amount with respect to compound (1).

The appellant-opponent argued that this amendment was not a correction within the meaning of Rule 139 EPC.

However, claim 5 of the main request finds a basis in claim 5 as originally filed in combination with the passage in page 5, lines 8-9. Since the features of claim 5 have a basis in the application as originally filed, as required by Article 123(2) EPC, it is irrelevant whether the amendment could also have been an allowable correction under Rule 139 EPC.

3.7 The appellant-opponent further argued that the amendment in claim 5 extended the scope of protection conferred by the patent as granted and thus contravened Article 123(3) EPC.

However, the scope of protection of the granted patent is defined by the process of its broadest claim, which is independent claim 1. Whether the scope of dependent claim 5 of the main request could be different from that of dependent claim 5 of the patent as granted is not relevant. The issue is whether the amendment extended the scope of independent claim 1. No argument has been put forward in this respect, and no issue is apparent to the board, either.

3.8 The claims of the main request thus fulfil the requirements of Article 123(2) and (3) EPC.

4. Sufficiency of disclosure

4.1 The claimed invention relates to a process which requires a defined relative amount of anhydrous HF.

4.2 The appellant-opponent argues that the claimed invention cannot be put into practice in all its essential aspects. Confronted with HF containing 200 ppm water, the skilled person would not know whether it was anhydrous (D14) or not (D15). The legal uncertainty arising from this fact proved the disclosure insufficient.

4.3 However, anhydrous HF can be obtained and purchased (D12, D13, D14). For this reason alone, this argument is not convincing. The appellant-opponent's argument could relate to a lack of clarity of the boundaries of the claimed subject-matter, but it does not render the claimed invention insufficiently disclosed.

4.4 The appellant-opponent further argued that completely anhydrous HF could not be obtained. The claimed invention, however, contemplated the use of that type of HF. Also for that reason, the claimed invention could not be put into practice.

The board agrees with the appellant-opponent that obtaining dry HF without any residual water is not trivial, at least due to its hygroscopicity. For this reason, HF containing very little water is considered anhydrous (D12 to D14). As the embodiment requiring HF without any water would not be contemplated by the skilled person as a realistic embodiment of the claimed

invention, the argument of the appellant-opponent is not convincing.

4.5 The claimed invention can thus be put into practice (Article 100(b) EPC).

5. Novelty

5.1 D1

The appellant-opponent argued at the oral proceedings before the board that the combination of claims 1 and 17 to 20 of D1 disclosed all the features of claim 1 of the main request.

Step (c) of claim 1 of D1 relates to the dehydrohalogenation of a compound of formula CF_3CFXCH_3, X being Cl or F. Only the latter is in formula (1) in claim 1.

Claim 17 of D1 requires step (c) of claim 1 to be carried out by metal catalysed dehydrohalogenation. The appellant argued that a metal catalyst inevitably required gas-phase conditions, as disclosed on page 13, lines 5-6.

However, the passage on page 13, lines 5-6 discloses that step (c) can be carried out in the vapour or liquid phase. If the process is in vapour phase, it typically requires a metal catalyst. This passage does not disclose the reverse link, as argued by the appellant-opponent: it does not disclose that a process over a catalyst inevitably requires the vapour phase. This is also in line with the broad range of suitable temperatures disclosed in claim 18, which starts at 0 °C.

The appellant-opponent argued that the temperatures in claim 18 must be read in combination with the pressure required to enable a gas-phase process. This is, however, not a limitation of D1.

Furthermore, claim 20 sets the relative amount of HF to "organics" in the dehydrofluorination step (c) of D1 from about 0.01:1 to about 50:1. Only the highest relative amount of HF disclosed in D1 corresponds to that required by claim 1. There is no direct and unambiguous disclosure, in combination, of the reaction of a starting material of formula 1 (X=F in claim 1, step c)) at the highest end of the broadest interval of HF (50:1, claim 20), which extends over three orders of magnitude.

D1 thus does not disclose the features of claim 1 in combination.

5.2 D2

The appellant-opponent argued that the combination of claims 1, 8, 13 and 17 with page 3, lines 4-5 of D2 disclosed the features of claim 1 of the main request.

Claim 17 of D2 discloses the preparation of 2,3,3,3-tetrafluoropropene, which is a compound of formula (2) of claim 1, by dehydrofluorinating 1,1,1,2,2-pentafluoropropane or dehydrochlorinating 1,1,1,2-tetrafluoro-2-chloropropane. Only the first option is according to claim 1.

Claim 8 of D2 discloses temperatures as low as -70 °C, at which the reaction mixture is arguably not in the gas phase.

The relative amount of HF of 50:1 is the highest limit of the relative amount of HF disclosed in D2. There is no clear and unambiguous disclosure of the starting material required by claim 1 in a gas-phase process with the required relative amount of HF.

D2 thus does not disclose, in combination, the features of claim 1.

5.3 D3

Example 5 of D3 discloses the dehydrofluorination of 243db, which is not a compound of formula (1) as defined in claim 1. This process, on a catalyst and in the gas phase, leads to the obtaining of both 1234yf and 245cb, which are respectively compounds of formula (2) and (1).

The appellant-opponent argued that, under the conditions of example 5, dehydrohalogenation of (1) to produce (2) was inevitable.

However, there is no proof that 1234yf arises from 245cb under the conditions of example 5. Document D10 discloses, on the contrary, that the obtaining of 1234yf from the starting material of example 5, 243db, follows a pathway which does not involve 245cb.

In addition, example 5 of D3 differs from the examples of the patent by virtue of the reaction temperature, the catalyst type and the presence of HCl. It cannot thus be concluded that 1234yf must have been prepared from 245cb in the process of D3 having regard to the patent's own disclosure, either.

D3 thus does not disclose the features of the claimed process.

5.4 The claimed process is thus novel (Article 54 EPC).

6. Inventive step

6.1 Closest prior art

Both parties considered example 2 of D2 to be the closest prior art. The board sees no reason to differ.

Example 2 of D2 discloses the dehydrofluorination of $CF_3CF_2CH_3$, which is a compound of formula (1), to produce $CF_3CF=CH_2$, a compound of formula (2), over a catalyst (page 22, line 16), in gas phase at 180 to 380 °C (page 22, line 25). The ratio HF:organics is either 15:1 or 5:1 (page 22, line 26). Table 3 discloses a 5:1 HF:organics ratio and temperatures ranging from 200 to 400 °C.

It was undisputed that example 2 of D2 does not disclose the relative amount of HF required by claim 1.

6.2 Technical problem underlying the invention

The respondent-patent proprietor defined the technical problem underlying the claimed invention as to provide a process for preparing compounds of formula (2) by dehydrofluorination of those of formula (1) with improved selectivity.

6.3 Solution

The solution to this technical problem is the claimed process, characterised by requiring more than 50 mol

anhydrous HF per mol of compound (1).

6.4 Success

Comparison of example 1 of the patent, with a relative amount of HF/245cb of 110, and comparative examples 5 and 6, with relative amounts of 49 and 10, shows increased selectivity linked to the relative amount of HF. The results in the patent were not put into question.

The appellant-opponent argued, however, that this effect would not be achieved throughout the whole scope of the claimed subject-matter, in particular at relative amounts of HF at the lower end required by claim 1 and for starting materials other than 245cb.

6.4.1 Enhanced selectivity at relative amounts of HF towards the lower end required by claim 1

Claim 1 requires a relative amount of more than 50 mol anhydrous HF per mol of compound (1). The patent does not provide data at the lower end; only at a relative amount of 110. This is not disputed.

The appellant-opponent relied on the data provided on the penultimate page of its statement of grounds of appeal, the admissibility of which was contested by the respondent-patent proprietor.

These data, albeit lacking experimental detail, were filed with the appellant-opponent's notice of opposition. They are discussed in the appealed decision (page 16, paragraph b). The opposition division, confronted with contradictory sets of data, one of which lacked experimental detail, concluded that the

data in the patent were more credible.

The statement of grounds of appeal includes the same data and provides the experimental conditions used. It is thus a response to the contested decision, filed at the earliest opportunity. The board thus admits them into the proceedings.

Assuming that the data of the appellant-opponent were carried out in the same conditions as in the examples of the patent, which the respondent-patent proprietor does not concede, the available data, rounded to two significant figures for comparison, is as follows:

HF/245cb	10	49	*49*	*51*	*70*	*90*	110
Selectivity 1234yf	84	88	*90*	*90*	*89*	*89*	90

Values obtained by the appellant-opponent are in italics. No information on the measurement error is available.

The appellant-opponent argues that comparison of the data at relative amounts of HF of 49 and 51 shows no effect: the selectivity is identical.

However, for inventive step, it is irrelevant whether enhanced selectivity is obtained comparing relative amounts of HF slightly over the set threshold, such as 51, with those slightly below, such as 49. The question is whether an improvement is achieved over the closest prior art, which discloses relative amounts of 5 and 15.

The data show enhanced selectivity at the relative amounts required by claim 1 (more than 50, last four entries on the table above) compared to at the relative

amount of HF in the closest prior art, 5 and 15, represented by comparative example 6 (first entry in the table above).

The board has no reason to doubt, either for technical reasons which could be common knowledge or having regard to the available evidence, that the effect sought would be obtained by every relative amount of HF over the threshold set by claim 1.

The appellant-opponent's argument is thus not convincing.

6.4.2 Enhanced selectivity of the preparation of every compound of formula (2)

The appellant-opponent argued that the available evidence only related to the preparation of 1234yf from 245cb. However, not every compound of formula (1) would dehydrofluorinate to produce a compound of formula (2) with enhanced selectivity towards the latter.

On the one hand, no experimental evidence supports the appellant-opponent's argument.

On the other, all the compounds of formula (1) have a methyl group linked to a carbon bearing a fluorine; this is the part of the molecule involved in the dehydrofluorination. The fluorine-bearing carbon is further substituted by fluorine or fluorinated alkyl of up to five carbon atoms. These substituents are not expected to change the reactivity of the molecule significantly. Thus, it is credible that all the compounds according to formula (2) would be obtained with better selectivity.

The argument of the appellant-opponent is thus not convincing.

6.4.3 The board thus concludes that the problem as formulated by the respondent-patent proprietor is credibly solved by the process of claim 1.

6.5 It 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 appellant-opponent has not relied on any passage of the prior art which could link the selectivity of the process with the relative amount of HF. None is apparent to the board, either.

The claimed solution would not have been obvious to a skilled person for this reason alone.

The claimed process generates one equivalent of HF. An excess of HF would thus inhibit the desired reaction to some extent. The prior art nevertheless discloses that HF helps to prevent decomposition of the organic feed and catalyst coking (D2, page 3, lines 2-3). The trade-off amount of HF is represented by that in example 2 of D2 (5 or 15) and is only a fraction of that required by claim 1 (more than 50). The skilled person would not have considered enhancing the amount of HF unless it could have expected that it would be linked to an advantage since they would expect it to prevent the process. There is, however, no prompt in this direction in the prior art.

The claimed process is thus inventive (Article 56 EPC).

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chair:

C. Rodríguez Rodríguez P. Gryczka

Decision electronically authenticated