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**Datasheet for the decision
of 24 October 2017**

Case Number: T 0292/16 - 3.3.10

Application Number: 07863530.7

Publication Number: 2076478

IPC: C07C17/25, C07C17/354,
C07C19/08, C07C19/10,
C07C19/14, C07C21/18

Language of the proceedings: EN

Title of invention:

PROCESS FOR THE MANUFACTURE OF FLUORINATED OLEFINS

Patent Proprietor:

Honeywell International Inc.

Opponent:

ARKEMA France

Headword:

Relevant legal provisions:

EPC Art. 123(2), 83, 56, 111(1)
RPBA Art. 13(1)

Keyword:

Amendments - allowable (no) - main request
First auxiliary request - allowable

Decisions cited:

Catchword:



Beschwerdekammern

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Case Number: T 0292/16 - 3.3.10

D E C I S I O N
of Technical Board of Appeal 3.3.10
of 24 October 2017

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Decision under appeal: **Decision of the Opposition Division of the
European Patent Office posted on 23 December
2015 rejecting the opposition filed against
European patent No. 2076478 pursuant to Article
101(2) EPC.**

Composition of the Board:

Chairman P. Gryczka
Members: R. Pérez Carlón
F. Blumer

Summary of Facts and Submissions

- I. The appeal lies from the decision of the opposition division to reject the opposition against European patent No. 2 076 478.
- 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 during the opposition proceedings include the following:

D1: US 5,986,151
D2: US 3,239,454
D3: EP 0 215 563 B1

During the appeal proceedings, the following documents were filed:

D8: EP 2 209 759 B1
D8a: WO 2009/064939 A2

- IV. The opposition division concluded that the claimed subject-matter found the required basis in the application as originally filed and that the invention was disclosed in a manner sufficiently clear and complete for it to be carried out by a person skilled in the art. Document D1 was the closest prior art, and the problem underlying the claimed invention was to provide an improved process for the production of a fluorinated olefin using hydrogenation and dehydrogenation reaction steps with high selectivity and conversion. The solution was characterised by a second hydrogenation step having a greater conversion

rate and a greater amount of catalyst than the first hydrogenation step. This solution was not obvious having regard to the prior art, so that the process of claim 1 of the patent as granted was inventive.

V. With a letter dated 12 September 2016, the respondent (patent proprietor) filed a main request and first to tenth auxiliary requests.

VI. Claim 1 of the main request reads as follows:

"A process for the production of a fluorinated olefin product comprising the steps of:

- (a) contacting a feed stream comprising fluorinated olefin and hydrogen reactants with a first amount of a catalyst to convert said reactants into a hydrofluoroalkane at a first conversion rate and to produce a first exit stream comprising said hydrofluorolkane [sic], unreacted fluorinated olefin and hydrogen;*
- (b) contacting said first exit stream with a second amount of a catalyst to convert said unreacted fluorinated olefin into a hydrofluoroalkane at a second conversion rate, wherein said second amount of catalyst is greater than said first amount of catalyst and wherein said second conversion rate is greater than said first conversion rate;*
- (c) dehydrohalogenating at least a portion of said hydrofluoroalkane from said contacting step (b) to produce a product stream comprising a fluorinated olefin and HF product; and*

(d) *optionally, separating said HF from said product stream."*

Claim 1 of the first auxiliary request is directed to a process for the production of a fluorinated olefin, having steps (c) and (d) identical to those of the main request. Steps (a) and (b) read as follows:

(a) *"contacting a feed stream comprising a fluoropropene having from three to six fluorine substituents and hydrogen reactants with a first amount of a catalyst to convert said reactants into a hydrofluoroalkane at a first conversion rate and to produce a first exit stream comprising said hydrofluoroalkane, unreacted fluoropropene and hydrogen;*

(b) *contacting said first exit stream with a second amount of a catalyst to convert said unreacted fluoropropene into a hydrofluoroalkane at a second conversion rate, wherein said second amount of catalyst is greater than said first amount of catalyst and wherein said second conversion rate is greater than said first conversion rate;"*

VII. The arguments of the appellant (opponent) relevant for the present decision were the following:

Main request

Claim 1 of the main request did not find the required basis in the application as originally filed, which neither referred to "hydrofluoroalkanes" as the result of step (a), nor disclosed either a feed comprising hydrofluoroalkane, unreacted olefin and hydrogen as the result of step (a), or the feature "to convert said

unreacted fluorinated olefin".

First auxiliary request

Deleting the wording "substantially", which could be found in claim 18 as originally filed resulted in undisclosed subject-matter. Claims 4-8 required features which could be found in claims 21 and 25-32 as originally filed; however these claims were only dependent on claim 19 as filed, which required a separation step with sulfuric acid, that was not a feature of claim 1. Lastly, paragraph [0022] of the patent in suit, which allegedly found a basis in claim 18 as filed but did not contain all the features of said claim, also represented added subject-matter. For these reasons, the first auxiliary request was not allowable.

The patent in suit did not contain sufficient information to enable the skilled reader to carry out every embodiment of claim 1 of the main request, as it only disclosed one catalyst (Pd/C). Documents D8 and D8a showed that Cu/C was only active over a certain temperature, whereas claim 1 did not contain any limitation in this respect. The patent did not teach how to obtain a conversion rate that was higher in the second step than in the first. The patent in suit already recognised that two hydrogenations could not suffice for achieving the required selectivity. Lastly, none of the examples of the patent in suit represented a process according to claim 1. For these reasons, the claimed invention was not sufficiently disclosed to be carried out by a person skilled in the art.

Document D1 was the closest prior art. It disclosed all the features of claim 1 with the exception of a second

hydrogenation step, carried out over a greater amount of catalyst, and with a greater conversion rate than the first step. The sole problem solved by the claimed invention was that of providing a further process for the production of a fluorinated olefin and the claimed solution, which was characterised by a second step (b) of converting unreacted fluoropropene of step (a) into a hydrofluoroalkane at a second conversion rate greater than that in step (a), over a catalyst amount greater than that in step (a), was a straightforward choice for a person skilled in the art. The claimed process was thus not inventive.

VIII. The arguments of the respondent relevant for the present decision were the following:

Main request

Claim 1 of the main request, and in particular the feature "hydrofluoroalkene", found a basis on page 3, lines 6-9 and 12-14, page 5, lines 12-13, page 6, line 30 to page 7, line 11, and page 10, lines 7-11 and 21-23 of the application as originally filed. For this reason, claim 1 of the main request did not contain subject-matter going beyond that of the application as originally filed.

First auxiliary request

Claim 1 of the first auxiliary request found the required basis in claim 18 in combination with page 5, lines 1-3, of the description as originally filed, claims 2 and 3 in claims 19 and 20 as originally filed, respectively. Claim 4 found a basis in the combination of claims 18, 25, 26 and page 5, lines 1-3. Claim 5 relates to the inevitable result of dehydrogenating

HFC-236ea. Lastly, claim 6 found a basis in the combination of claims 18 and 29 and page 5, lines 1-3 and claim 7 on claims 18, 30 to 32 and page 5, lines 1-3, of the application as originally filed. For these reasons, the claims of the first auxiliary request did not contain added subject-matter.

Document D8a, filed during the appeal with a letter dated 19 October 2017, only five days before the oral proceedings before the board, should not be admitted into the proceedings, as filing it so late was an abuse of procedure.

Document D1 was the closest prior art. The problem underlying the claimed invention was to provide a process for the production of a fluorinated olefin with improved conversion and selectivity. If, nevertheless, the problem underlying the claimed invention were to be considered as merely providing an alternative, the claimed solution according to the first auxiliary request, which was characterised by a second step (b) of converting unreacted fluoropropene of step (a) into a hydrofluoroalkane at a second conversion rate greater than that in step (a), over a catalyst amount greater than that in step (a), was not hinted at by the prior art. The claimed process was thus inventive.

- IX. Oral proceedings before the board of appeal took place on 24 October 2017.
- X. The final requests of the parties were the following:
 - The appellant requested that the decision under appeal be set aside and that European patent No. 2 076 478 be revoked.

- The respondent requested that the decision under appeal be set aside and the patent be maintained on the basis of the main request, or, subsidiarily, on the basis of any of the first to tenth auxiliary requests, all requests as filed with letter dated 12 September 2016.

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

Reasons for the Decision

1. The appeal is admissible.

Main request, amendments

2. Claim 1 of the main request relates to a multi-step process for the production of a fluorinated olefin product. Claim 1 requires the product of step (a) to be a hydrofluoroalkane.

Claim 18 of the application as originally filed was also directed to a multi-step process for the production of a fluorinated olefin, but required the product resulting from step (a) to be a hydrofluorocarbon.

The question thus arises whether the feature "hydrofluoroalkane" finds the required basis in the application as originally filed.

3. The respondent relied on the following passages of the application as originally filed as a basis for this feature:

3.1 Page 3, lines 6-9 and 12-14

This passage discloses a process producing an olefin having N halogen atoms by hydrogenation of an olefin having a number of halogen substitution of N+1 to form "one or more fluorinated alkanes".

This passage excludes, for example, processes in which an olefin having two double bonds is hydrogenated, and then dehydrohalogenated twice to yield a product having two halogen atoms less. Such a process is, however, an embodiment of claim 1 of the main request.

For this reason, contrary to the arguments of the respondent, the passage on page 3 does not provide a basis for a process via a hydrofluoroalkane in general but only via a specific type thereof.

3.2 Page 5, lines 12-13

This passage reads "*[i]n certain preferred embodiments the fluorinated alkane produced by the conversion step has a degree of fluorine substitution of N+1*".

The respondent argued that, if a fluorinated alkane having a degree of fluorine substitution of N+1 was a preferred embodiment of the claimed invention, that inevitably disclosed that a fluorinated alkane without any limitation with respect to the degree of fluorine substitution was also an embodiment thereof.

However, the passage cited does not disclose more than what is disclosed on page 3 (see point 3.1), i.e. that hydrofluoroalkanes are suitable intermediates in the process of producing olefins having N halogen atoms from olefins having N+1 halogen atoms. It discloses

neither intermediates other than fluorinated alkanes, nor a number of halogen substituents other than N+1.

3.3 Page 6, line 28, to page 7, line 11

This passage discloses a product stream containing "*a fluorinated alkane in accordance with the present invention*", and is to be read in the context of the "detailed description" starting on line 11 of page 6, which refers to the fluorination of an olefin having a degree of halogen substitution of N+1 (page 6, lines 13-14), leading to a fluorinated olefin having a degree of halogen substitution of N (page 7, lines 2-3), i.e. having one halogen less, which are not features of claim 1.

3.4 Page 10, lines 7-11 and 21-23

These passages refer to preferred embodiments requiring "*the fluorinated alkane*" or "*the fluorinated alkane in accordance with the present invention*", i.e. they refer to a specific fluorinated alkane previously defined in the description, which either contains N+1 halogen substituents and is converted into an olefin having N halogen atoms, or is a fluorinated alkane of formula (II) or (IIA). For this reason, these passages do not provide the required basis for the feature hydrofluoroalkane, either.

3.5 Thus, the passages relied upon by the respondent do not provide the required basis for the feature "hydrofluoroalkane", but only for one of a specific type thereof. For this reason, it is concluded that claim 1 of the main request contains subject-matter going beyond that of the application as originally filed, with the consequence that the ground of

opposition under Article 100(c) EPC precludes the maintenance of the patent in the form of the main request.

First auxiliary request

4. Amendments

4.1 Claim 1 of the first auxiliary request finds a basis in the combination of claim 18 as originally filed and the passage in the description on page 5, lines 1-3, according to which the starting olefin (IA) is preferably a fluoropropene having from three to six fluorine substituents.

Claims 2 and 3 find the required basis in claims 19 and 20 as originally filed, respectively.

Claim 4 finds a basis in the combination of claims 18, 25 and 26 with the passage on page 5, lines 1-3. Although claims 25 and 26 were dependent not on claim 18 but on claim 19 requiring, as claim 2 of the first auxiliary request, a mandatory separation of HF with sulfuric acid, the skilled reader would recognise that said features are not necessarily interconnected, i.e. that the selection of a particular intermediate alkene does not have any bearing in the type of process required for separating HF in step (d). For the same reasons, claim 6 finds a basis in the combination of claims 18 and 29 and page 5, lines 1-3 as filed, and claim 7 finds a basis in the combination of claims 18, and 30 to 32 with page 5, lines 1-3 as filed.

$\text{CFH}=\text{CFCF}_3$ can be found in claim 28 as originally filed, although it is not clear whether it corresponds to the starting material for step (a) of claim 1 or to the

product of step (c). However, $\text{CFH}=\text{CFCF}_3$ is a dehydrohalogenation product of 1,1,1,2,3,3-hexafluoropropane (HFC-236ea; page 5, lines 11-12 of the application), which is a hydrofluoroalkane resulting from step (a) of claim 1 and whose dehydrohalogenation is disclosed in example 3. For this reason, claim 5, which requires $\text{CFH}=\text{CFCF}_3$ to be the product of the process of claim 1, finds the required basis in the application as originally filed.

- 4.2 The appellant argued that the application as filed did not disclose a first exit stream comprising hydrofluoroalkane, unreacted fluoropropene and hydrogen, as required by claim 1.

It is not disputed that these compounds are the inevitable result of carrying out step (a) of claim 1, and the application as originally filed does not disclose any separation of these compounds. The skilled reader will thus assume that they shall leave the reactor or reactor zone in which step (a) is carried out without being separated. For this reason, the appellant's argument is rejected.

- 4.3 The appellant also argued that, by deleting the wording "substantially" in combination with the amount of catalyst and the conversion rate in the second step, claim 1 contained subject-matter going beyond that of the application as originally filed.

However, the application, on page 10, lines 13-15, contains the feature *"to convert the fluorinated olefin [...] at a conversion rate that is greater than [...] the conversion percentage in the first reaction stage"* and, on page 13, lines 21-22, it discloses the amount of catalyst in step (b) to be greater than that in step

(a).

- 4.4 The appellant also argued that the feature "to convert said unreacted fluoropropene" "at a second conversion rate" did not find the required basis.

However, step (b) must necessarily be carried out at a conversion rate, as this is inherent to every chemical process.

- 4.5 The appellant further argued that claim 32 as originally filed related to a dehydrofluorination, whereas claim 7 of the main request required a dehydrohalogenation, in general.

However, claim 7 requires a dehydrohalogenating step comprising a catalysed dehydrofluorination, as required by original claim 32, which was dependent on claim 30. Thus, claim 7 does not contain subject-matter not present in the application as filed.

- 4.6 Lastly, the appellant argued that the amendment to paragraph [0022] of the patent in suit added subject-matter. This passage should originate from the wording of claim 18 as originally filed; however, the remaining features of said claim had not been incorporated into said passage.

The claimed invention is directed to a process according to claim 1. For this reason alone, it is irrelevant whether a passage of the description contains only a part of the features of claim 1. In fact the description of an invention often focuses on different features in different passages, by providing a more in-depth disclosure of each of them but, notwithstanding that, all of them are obviously to be

considered within the context of the remaining features of the claimed subject-matter. This argument is thus rejected.

5. Admission of document D8a

5.1 The respondent requested that document D8a not be admitted into the proceedings, as it was only filed a few days before the oral proceedings before the board. However, as D8a is in fact merely the international application on which D8 is based, the board used its discretion under Article 13(1) RPBA to allow this document into the proceedings.

6. Sufficiency of disclosure

6.1 Claim 1 relates to a process for the production of a fluorinated olefin, which comprises two catalytic hydrogenation steps (a) and (b), an hydrodehalogenation step producing HF (c), and an optional separation step (d). Each of these reactions is well known per se.

6.2 The appellant argued that the patent in suit did not contain sufficient information for it to be carried out by a person skilled in the art throughout the whole scope of the claimed subject-matter, for the following reasons:

6.2.1 The patent in suit only disclosed one hydrogenation catalyst suitable for the claimed invention, namely Pd on carbon. Claim 1, however, was not limited with respect to the catalyst, and also included the possibility of using different types of hydrogenation catalysts in steps (a) and (b). Documents D8 and D8a showed that not every catalyst was suitable for carrying out the claimed reaction at every temperature,

as Cu/C was not active below 200°C.

However, claim 1 is directed to a process comprising catalytic hydrogenation and dehydrohalogenation, which are well-known processes. It is not disputed that catalysts for these processes are known, and the reaction conditions required when using them are also within the knowledge of the skilled person (D1, D5).

The skilled person would thus not find any difficulty in selecting catalysts and reaction conditions suitable for the claimed process. The fact that not every catalyst is suitable for this process is self-evident and is irrelevant for the question of sufficiency of disclosure of the invention.

- 6.2.2 The appellant further argued that the patent in suit did not disclose how to achieve a conversion rate in the second reactor that is higher than in the first and that, in order to achieve it, experimentation was required. The appellant also argued that the patent in suit did not disclose at which point in the process the temperature should be controlled.

Increasing the conversion rate, for example by increasing temperature or modifying pressure, falls within the skills of a chemist, who would find suitable conditions to do so. The board fails to see why the lack of information on the point of temperature control could call into question the ability or otherwise of the skilled person to carry out the invention.

- 6.2.3 The appellant further argued that the patent in suit recognised [0027] that two hydrogenations could not be sufficient in order to achieve good selectivity.

However, as claim 1 did not require any specific level of selectivity, whether or not two hydrogenation steps suffice in order to achieve the desired result is not an issue which could call into question the sufficiency of disclosure of the invention.

- 6.2.4 Lastly, the appellant argued that none of the examples of the patent in suit represented a process according to claim 1, as none carry out steps (a) through (c).

Even if none of the examples discloses the complete sequence of steps required by claim 1, as examples 1 and 2 relate to steps (a) and (b), and examples 3 to 8 disclose step (c) over apparently pure hydrofluoroalkanes, the application contains sufficient information allowing the skilled reader to put the invention into practice.

It is not disputed that some experimentation might be required, but the appellant has failed to show that this experimentation would represent an undue burden for the person skilled in the art. The skilled person would not find any difficulty in carrying out a dehydrohalogenation according to step (c) of the product resulting from the hydrogenation of a fluorinated propene, or over a portion of said product, even in the absence of a specific example in the patent in suit.

- 6.3 It is thus concluded that the patent in suit sufficiently disclosed the claimed invention.

7. Inventive step

7.1 Closest prior art

The opposition division and the parties considered that document D1 was the closest prior art. The board sees no reason to differ.

D1 discloses the preparation of $\text{CF}_3\text{-CH=CH}_2$ by hydrogenating $\text{CF}_3\text{-CH=CHF}$ to produce $\text{CF}_3\text{-CH}_2\text{-CH}_2\text{F}$ (examples 13-17), and dehydrofluorinating the latter (examples 19 and 20).

D1 does not disclose a second hydrogenation step, carried out over a greater amount of catalyst with a conversion rate greater than the first step.

7.2 Technical problem underlying the invention

The parties had different views as to the formulation of the technical problem underlying the invention.

The respondent considered that the technical problem should be seen as providing a process which made it possible to improve conversion and selectivity with respect to that of D1.

The appellant argued that the sole problem solved by the claimed invention was that of providing an alternative process for the production of a fluorinated olefin.

The question of whether or not the problem as formulated by the respondent has been solved in all aspects can be left aside, since the board holds that even if the technical problem is reformulated as merely the provision of alternative process for the production of a fluorinated olefin, the appellant's argument that the proposed solution is obvious is not convincing for

the reasons given below.

7.3 Solution

7.3.1 The solution to the technical problem of providing an alternative process according to claim 1 is characterised in that unreacted fluoropropene of step (a) is converted into a hydrofluoroalkane in a second step (b), at a second conversion rate greater than that in step (a), over a catalyst amount greater than that in step (a).

7.3.2 The appellant argued that the greater conversion rate of step (b) was the inevitable result of the presence of more catalyst. For this reason, it should not be considered that both features contributed to the solution of the problem.

However, a greater conversion rate is not the inevitable result of the use of a larger amount of catalyst, as other factors such as reaction temperature, pressure and catalyst activity also play a role.

7.4 Success

By carrying out steps (a) to (c), a fluorinated olefin product is obtained. The problem as defined in 7.2 above is thus credibly solved by the features of claim 1. This was not disputed.

7.5 It thus remains to be decided whether the proposed solution to the objective problem defined above is obvious in view of the available prior art.

The appellant argued that a skilled person, trying to

obtain a further process for the production of a fluorinated olefin, would consider using a two-step hydrogenation such as those disclosed in documents D2 and D3, which also relate to hydrogenations over Pd catalysts, and would arrive at the claimed invention without using inventive skills.

Document D2 relates to the hydrogenation of hydrocarbon feeds followed by hydrodesulfurisation, whereby the latter reaction is carried out at a higher temperature than the first (column 2, lines 56-60). The aim of the process of D2 is to enable desulfurisation catalysts to remain on-stream for longer periods (column 4, lines 51-53). It is not feasible to carry out both processes in a single operation, since the high temperatures required by dehydrosulfuration promote coke formation, olefin polymerisation and hydrogenation of aromatics to naphthenes, which reduce the activity of the hydrogenation catalyst (column 1, lines 56-67). The feed employed usually contains aromatic hydrocarbons, olefins, diolefins, sulfur compounds and possibly acetylenes (column 1, lines 11-14). D2 thus relates to a very different process carried out over very different starting materials and having a different aim. For this reason, the skilled person would not consider combining the teaching of document D2 with that of D1.

Similarly, document D3 discloses the hydrogenation of aldehydes to yield the corresponding alcohol. The preferred embodiment refers to the hydrogenation of an alpha,beta-unsaturated aldehyde (2-ethylhex-2-enal), which has a reactivity quite different from that of a fluorinated propene. The skilled person would thus not have combined the teaching of D3 with that of document

D1.

7.6 Lastly, the appellant argued that it belonged to the common technical knowledge to carry out a hydrogenation in two steps, using the claimed conditions. However, the appellant has failed to provide any evidence in support of this argument.

7.7 For these reasons, none of the arguments put forward by the appellant can lead to the conclusion that the subject-matter of claim 1 is not inventive.

Remittal

8. The description of the patent as granted contains subject-matter not within the scope of the claims of auxiliary request 1 (see for example [0007]) and thus requires amendment (Article 84 EPC). The board decided to make use of its discretion to remit the case to the opposition division for the description to be adapted (Article 111(1) EPC).

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 on the basis of the first auxiliary request (claims 1 to 7) as filed with letter dated 12 September 2016 and a description yet to be adapted.

The Registrar:

The Chairman:



C. Rodríguez Rodríguez

P. Gryczka

Decision electronically authenticated