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**Datasheet for the decision
of 12 September 2024**

Case Number: T 1405/22 - 3.3.02
Application Number: 13867735.6
Publication Number: 2920159
IPC: C07D301/10, C07D301/08,
C07D301/04
Language of the proceedings: EN

Title of invention:

START-UP PROCESS FOR HIGH SELECTIVITY ETHYLENE OXIDE CATALYSTS

Patent Proprietor:

Scientific Design LLC

Opponent:

Shell Internationale Research Maatschappij B.V.

Relevant legal provisions:

EPC Art. 56, 83, 123(2)

Keyword:

Inventive step
Sufficiency of disclosure
Amendments

Decisions cited:

G 0003/14, T 0083/13



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Case Number: T 1405/22 - 3.3.02

D E C I S I O N
of Technical Board of Appeal 3.3.02
of 12 September 2024

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Decision under appeal: **Decision of the Opposition Division of the
European Patent Office posted on 24 March 2022
rejecting the opposition filed against European
patent No. 2920159 pursuant to Article 101(2)
EPC.**

Composition of the Board:

Chairman M. O. Müller
Members: P. O'Sullivan
B. Burm-Herregodts

Summary of Facts and Submissions

- I. The appeal of the opponent (hereinafter appellant) lies from the decision of the opposition division to reject the opposition against European patent EP 2 920 159.
- II. The following documents *inter alia* were submitted by the parties in opposition proceedings:
- D1: US 2011/0152548 A1
D4: WO 2004/002972 A2
D8: WO 2004/002954 A2
D17: WO 2010/123844 A1
- III. In their submissions in appeal, the parties referred to the following documents:
- D19: Supplementary report dated 26 January 2017 provided by the respondent during examination proceedings, and
D20: Additional data provided by the appellant (Appendix 1, pages 45-57 of the notice of opposition).
- IV. A communication pursuant to Article 15(1) RPBA was sent in preparation for the oral proceedings. Therein the board *inter alia* expressed the preliminary view that neither of the grounds for opposition under Article 100(b) and (c) prejudiced the maintenance of the patent as granted.
- V. Oral proceedings by videoconference were held as scheduled on 12 September 2024 in the presence of both parties.

VI. Requests relevant to the present decision

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

The respondent (patent proprietor) requested that the appeal be dismissed, implying maintenance of the patent as granted.

VII. For the text of claim 1 of the main request, reference is made to the reasons for the decision set out below.

VIII. For the relevant party submissions, reference is made to the reasons for the decision set out below.

Reasons for the Decision

1. Basis of appeal proceedings

1.1 The appellant's submissions set out in the statement of grounds of appeal are structured in such a way as to include, for each main issue, five sections labelled A to E. These can be summarised as follows:

- A: arguments in the notice of opposition,
- B: arguments set out in a further letter submitted in opposition proceedings,
- C: points emphasised at oral proceedings before the opposition division,
- D: the position of the opposition division in the contested decision, and
- E: "Discussion"

- 1.2 According to Article 12(1)(a)-(c) RPBA, appeal proceedings shall *inter alia* be based on the decision under appeal, the statement of grounds of appeal and any written reply of the other party or parties.
- 1.3 According to Article 12(2) RPBA, a party's appeal case shall be directed to the requests, facts, objections, arguments and evidence **on which the decision under appeal was based**. According to Article 12(3) RPBA, the statement of grounds of appeal and the reply shall contain a party's complete appeal case and *inter alia* shall set out **clearly** and **concisely** the reasons why it is requested that the decision under appeal be reversed, amended or upheld (emphasis added by the board).
- 1.4 These provisions are intended *inter alia* to ensure that appeal proceedings are not a mere re-examination of the opposition. Rather, the main purpose of appeal proceedings is to review the decision under appeal in a judicial manner (Article 12(2) RPBA). It is for the appealing party or parties to set out the reasons why the decision under appeal is considered incorrect (Article 12(3) RPBA).
- 1.5 Therefore, submissions made in opposition proceedings are only relevant in appeal proceedings insofar as they relate to the reasons why the appealing party finds the decision incorrect. In this regard, it is not the task of the board to sift through all submissions from opposition proceedings to determine which specific submissions are relevant to said reasons in appeal proceedings: this is the task of the parties.

1.6 In the present case, in sections A-C, the appellant included the submissions from opposition proceedings into its appeal submissions, seemingly in a copy-paste fashion, without identifying the specific issues pertinent to appeal proceedings. In these sections A-C the appellant fails to explain why the appealed decision should be set aside. Therefore, this part of the appellant's submission does not comply with Article 12(3) RPBA.

1.7 As a consequence, and as stated in the board's communication pursuant to Article 15(1) RPBA, the board consulted sections A to C of the appellant's statement of grounds of appeal only to the extent necessary to understand the appellant's specific submissions under Sections D and E. This manner of proceeding was not contested by the appellant after the issuance of the board's communication.

Main request (patent as granted)

2. Amendments - Articles 100(c) and 123(2) EPC

2.1 Claim 1 of the main request (patent as granted) reads as follows:

"A method for the start-up of a process for the epoxidation of ethylene comprising:

*initiating an epoxidation reaction by reacting a feed gas composition containing ethylene, oxygen and a chloride moderator **selected from the group consisting of C1-C8 halohydrocarbons** in the presence of a **high selectivity** silver-based epoxidation catalyst at a first temperature from about 180°C to about 230°C, wherein said chloride moderator is present in the feed*

gas composition at a concentration **equal to or** ~~of~~ greater than ~~1~~**2** ppm, and wherein said epoxidation reaction has a selectivity of less than 86%;

increasing the first temperature to a second temperature of about 235°C to about 270°C at a ramp of 0.5°C/h to about 10°C/h in the presence of the feed gas composition used during said initiating;

maintaining the second temperature over a time period of from about 10 hours to about 400 hours in the presence of the feed gas composition used during said initiating;

reducing the concentration of the chloride moderator in the feed gas composition below that used during said initiating **and which is from 0.5 ppm to 3 ppm**; and

reducing the second temperature to a third temperature **of from 180°C to 245°C** in the presence of said feed gas composition including said reduced concentration of chloride moderator." (emphasis added; bold text added and strike through text deleted compared to claim 1 of the application as filed).

- 2.2 The appellant's sole objection related to the amendment of the concentration of chloride moderator present in the feed from "greater than 1 ppm" in claim 1 of the application as filed to "**equal to or** greater than **2** ppm" in claim 1 of the main request. Hence, the appellant argued that there was no basis in the application for the point value of 2 ppm in the context of claim 1.

- 2.3 It was not disputed that "greater than 2 ppm" in claim 1 found basis in the application as filed, e.g. in claim 3.
- 2.4 According to the contested decision, the addition of "equal to" found basis in the examples of the application as filed in which a concentration of 2 ppm chloride moderator was used (e.g. table 1, paragraph [0068]), in combination with claim 1, which discloses "greater than 1 ppm" and claim 3, which discloses "greater than 2 ppm".
- 2.5 The appellant argued that this conclusion was incorrect. Specifically, the gold standard had not been applied correctly, since with this amendment in claim 1, the skilled person was provided with new technical information which gave the respondent an unwarranted advantage and improved its position. Although "greater than 1 ppm" in claim 1 of the application as filed covered the specific value of 2 ppm, the value "equal to or greater than 2 ppm" was nevertheless a sub-range lacking any basis. Furthermore, the disclosure of a concentration of 2 ppm in the examples could not be generalised because that value was inextricably linked to the specific catalyst and operating conditions of the example in question.
- 2.6 The board disagrees. Even if it were to be assumed, to the appellant's advantage, that the application as filed fails to disclose a direct and unambiguous *general* disclosure of the specific point value of 2 ppm for the chloride moderator concentration, its inclusion in claim 1 of the main request does not add subject-matter.

2.7 Specifically, as argued by the respondent, "equal to or greater than 2 ppm" does not imply a different technical teaching to "greater than 2 ppm", and hence the skilled person is not presented with new technical information. In the view of the board, there is no practical method, in terms of measurement techniques, for the skilled person to distinguish the value of 2 ppm from the lower limit of the range "greater than 2 ppm". Hence, from a technical perspective, the amendment does not result in subject-matter extending beyond the application as filed (see for example Case Law of the Boards of Appeal, 10th Edition, II.E.1.5.2 c, in particular in relation to decision T 83/13; final paragraph of page 516 in the English language edition).

2.8 It follows that the expression "equal to or greater than 2 ppm" in claim 1 does not add subject-matter.

2.9 Consequently, the ground for opposition under Article 100(c) EPC does not prejudice maintenance of the patent as granted.

3. Sufficiency of disclosure - Article 100(b) EPC

3.1 The appellant's objections in relation to sufficiency of disclosure concern:

- the feature of claim 1 wherein the epoxidation reaction has a selectivity of less than 86%;
- the "chloriding effectiveness" of the chloride moderator, and
- whether the concentration of chloride moderator in claim 1 is expressed in ppmv or ppmw (i.e. volume based or weight based), and the components

relative to which the amount in ppm is determined.

Each of these objections are addressed in turn in the following.

3.2 Selectivity of less than 86%

3.2.1 The appellant argued essentially that the feature whereby the epoxidation reaction has a selectivity of less than 86% had no technical relevance to the claimed invention. The achievement of this selectivity using the claimed level of chloride moderator was not surprising, since the same selectivity could be achieved with lower amounts of chloride moderator.

3.2.2 As set out in the board's communication pursuant to Article 15(1) RPBA, and not subsequently commented on by the appellant, the board has some difficulty understanding this argument. However, as stated by the respondent, it seems to be of no relevance to the issue of sufficiency of disclosure. On the basis of the examples of the patent and the common general knowledge, there is no reason to conclude that the skilled person is unable to carry out the claimed invention. No evidence has been presented in this regard. Hence, this argument fails.

3.3 Chloriding effectiveness of the chloride moderator

3.3.1 The appellant argued that the concentration of the chloride moderator in claim 1 was not to be equated with the "chloriding effectiveness" thereof as defined in D17 (paragraph [0035]). It was the latter which was important in the catalytic epoxidation reaction, since it took into account the variations in the type of

chloride moderator as well as saturated hydrocarbon concentrations (e.g. ethane rather than ethylene used in the reaction). As the board understands it, the appellant therefore essentially argued that merely stating the chloride moderator concentration in the claim was not enough to determine the catalyst performance. Hence, the skilled person had no way of knowing whether the operating conditions would lead to the promised technical effects.

3.3.2 The board disagrees. Claim 1 is a method claim. For the requirements of sufficiency of disclosure to be met, the skilled person must be capable of carrying out the method given the information in the application as filed and the common general knowledge. As stated by the respondent, on the basis of the information in the patent, in particular the examples thereof, there is no reason to conclude that the skilled person would be unable to perform the claimed method. Whether a certain effect is achieved by the claimed subject-matter is only relevant for sufficiency of disclosure to the extent that the effect is part of the claimed subject-matter, which is not the case in relation to claim 1 of the main request. Therefore, also this argument fails.

3.4 Concentration of chloride moderator: ppmv or ppmw, and the components relative to which the amount in ppm is determined

3.4.1 The appellant argued that the concentration of "2 ppm" chloride moderator present in the gas feed composition according to claim 1 was not sufficiently disclosed since:

- it had not been specified whether the unit, "ppm" is volume- or weight-based, and

- the basis for the amount of chloride moderator had not been specified.

- 3.4.2 The board disagrees. As stated by the respondent, at least paragraph [0052] of the application as filed indicates the presence of the chloride moderator in ppmv, indicating to the skilled person that the concentration is expressed in these units. The reference to the unit "ppmw" on page 8, line 45 of the patent (corresponding to paragraph [0055] of the application as filed) is not relevant, since this paragraph only describes a disclosure of a specific prior art document.
- 3.4.3 It is also explicitly stated in claim 1 that the concentration of 2 ppm chloride moderator is provided "in the feed gas composition", such that the "basis" for the amount is unambiguous.
- 3.5 Lastly, even if there was some merit to the above arguments, any ambiguity as regards the concentration of the chloride moderator in the feed gas would at best be a lack of clarity under Article 84 EPC rather than a sufficiency issue. Lack of clarity can however not be invoked in view of the fact that the main request is based on the granted claims (G 3/14).
- 3.6 In view of the foregoing, the ground for opposition under Article 100(b) EPC does not prejudice maintenance of the patent as granted.
- 4. Inventive step - Article 100(a) and 56 EPC
 - 4.1 The appellant submitted that the subject-matter of claim 1 lacked inventive step starting from D1 or D4 as closest prior art.

4.2 Claim 1 of the main request, set out in full above, is directed to a method for the start-up of a process for the epoxidation of ethylene. It comprises a series of steps, for convenience abbreviated as follows:

the initiating step

Initiating the reaction by reacting a feed gas composition containing ethylene, oxygen and a chloride moderator selected from the group consisting of C1-C8 halohydrocarbons in the presence of a high selectivity silver-based epoxidation catalyst at a first temperature from about 180°C to about 230°C, wherein said chloride moderator is present in the feed gas composition at a concentration equal to or greater than 2 ppm, and wherein said epoxidation reaction has a selectivity of less than 86%;

the increasing step

Increasing the first temperature to a second temperature of about 235°C to about 270°C at a ramp of 0.5°C/h to about 10°C/h in the presence of the feed gas composition used during said initiating;

the maintaining step

Maintaining the second temperature over a time period of from about 10 hours to about 400 hours in the presence of the feed gas composition used during said initiating;

the chloride reducing step

Reducing the concentration of the chloride moderator in the feed gas composition below that used during said *initiating* and which is from 0.5 ppm to 3 ppm; and

the temperature reducing step

Reducing the second temperature to a third temperature of from 180°C to 245°C in the presence of said feed gas composition including said reduced concentration of chloride moderator."

4.3 Claim interpretation

4.3.1 The interpretation of claim 1 is relevant to the issue of inventive step. First, the interpretation of the expression "in the presence of the feed gas composition used during said initiating" in the increasing and maintaining steps of claim 1, which was a matter of dispute in written appeal proceedings, was agreed upon by the parties during oral proceedings (as regards the appellant, see minutes, page 3, third paragraph, first sentence). This interpretation corresponded to that set out by the board in its communication pursuant to Article 15(1) RPBA: the expression is understood to indicate that the feed gas composition is identical in the first three steps of claim 1, namely the initiating, increasing and maintaining steps. Consequently, claim 1 does not allow changes to the feed gas composition during the initiating, increasing and maintaining steps. It also follows that the expression "in the feed gas composition" in the chloride reducing step refers to the feed gas composition of the previous three steps. Hence, in this step, only the chloride moderator concentration is reduced.

4.3.2 Second, the appellant argued that the expression "maintaining the second temperature" in the maintaining step, rather than representing a specific temperature, merely required that the temperature be maintained within the claimed range provided for the second

temperature in the increasing step, namely "about 235°C to about 270°C". Hence, even if the temperature was increasing during the maintaining step, as long as the increase fell within the claimed range for the second temperature, it still fell within the scope of claim 1.

- 4.3.3 The board disagrees. The appellant's interpretation does not fit with a technically reasonable reading of claim 1. The initiating step of claim 1 requires **a** first temperature, which may be chosen from within the range stipulated. The increasing step clearly states that the temperature is **raised** to **a** second temperature, which may also be chosen from within the range stipulated. The use of the indefinite article "a" indicates that a specific temperature is intended. Finally, the second temperature **is maintained** in the maintaining step of claim 1. Since the term "raised" is used in claim 1 when an upward change in temperature is intended, the term "maintained" must be interpreted to mean that the temperature is not raised, i.e. it remains the same. Hence, "maintaining the second temperature" in the maintaining step of claim 1 excludes raising the temperature within the range provided for the second temperature. Rather, in the process of claim 1, a specific second temperature may be chosen from within the range of "about 235°C to about 270°C" set out for the second temperature in the increasing step, and the temperature remains at this chosen level during the maintaining step.

5. Inventive step starting from D1

5.1 Distinguishing features

5.1.1 D1 concerns a start up process for an epoxidation process in the presence of a silver-based highly

selective epoxidation catalyst (claim 1, paragraph [0010]).

5.1.2 According to the process of D1 (see claim 1), in an initiating step, the first temperature is in the range of about 180 to 210 °C, and the start-up feed comprises ethylene, oxygen and about 0.05 to 2 ppm of moderator, which may be e.g. ethyl chloride (D1, claim 5).

5.1.3 In a second step (D1, claim 1), the temperature is **increased** to a second temperature of about 240 to 250°C over a period of about 12 to about 60 hours. This temperature is **maintained** for a period of about 50 hours.

5.1.4 It was undisputed by the parties that the subject-matter of claim 1 was distinguished from D1 in the following manner:

- D1 fails to disclose that in the initiating step, the epoxidation reaction has a selectivity of less than 86%;
- D1 fails to disclose that the increasing and maintaining steps are carried out in the presence of the (same) feed gas composition used during the initiating step: paragraph [0037] of D1, which describes said steps, indicates that as the temperature is increased, the levels of ethylene and oxygen in the feed are also increased to boost the production level of ethylene oxide, and
- D1 fails to disclose the final two steps of contested claim 1, namely the chloride reducing step and the temperature reducing step.

5.2 Objective technical problem

The respondent argued that the objective technical problem was the provision of an alternative process reaching a high level of selectivity at operational level.

- 5.2.1 The board agrees. As noted by the respondent, high selectivity in operation was demonstrated for the claimed process in the appellant's data set out in D20. In D20, the appellant set out tests comparing an epoxidation start-up process according to claim 1 with a start-up process in which the chloride modifier was present at 1 ppm in the feed gas composition, i.e. outside the scope of claim 1. Specifically, in figure 6, it was demonstrated that a process according to claim 1 in which the chloride moderator concentration in the feed of the initiating, increasing and maintaining steps was 4.5 ppm ("Rx B"; blue triangles) demonstrated high selectivity during operation.
- 5.2.2 The appellant disagreed with the respondent's formulation of the objective technical problem. It was submitted that the objective technical problem was the provision of a mere alternative to the start-up process of D1. In particular, it was argued that there was no general causal link between the specific steps of a start-up process and the obtention of high selectivity at the operational level. Therefore, the objective technical problem could not include the aspect of "high selectivity during operation". The appellant referred to *inter alia* figure 6 of D20 as evidence for its allegation. Specifically, although high selectivity was demonstrated in figure 6 for the claimed process (for catalyst "Rx B"), no difference in selectivity could be discerned over a catalyst (Rx A, red squares) for which

the chloride moderator concentration in the feed of the initiating, increasing and maintaining steps of the start-up process was 1 ppm, i.e. outside the claimed range (see D20, page 47, first complete paragraph and page 48, table A).

5.2.3 The board disagrees with the appellant's argument. As stated by the respondent, the example at 1 ppm chloride moderator in figure 6 of D20, i.e. outside of the claimed range, does not represent a comparison with the closest prior art D1, and therefore cannot demonstrate the absence of a technical effect. Furthermore, this comparison does not support the appellant's broad-brush allegation that there is no causal link between the specific steps of a start-up process and the obtention of high selectivity at the operational level. Rather, figure 6 merely demonstrates that for a specific embodiment, operating a start-up process having one feature falling outside of the claimed range does not affect selectivity at the operational level. This however provides no information according to which one could conclude that the nature of the start-up process in general has no effect on operational selectivity.

5.2.4 The appellant's allegation is also neither supported by the prior art nor by the common general knowledge. Specifically, the appellant argued that all of the prior art processes also achieve high selectivity irrespective of the start-up process. However, as noted by the respondent, the fact that differing start-up processes may all lead to high selectivity does not indicate that the nature of the start-up procedure does not influence operational selectivity. Rather, as discussed at oral proceedings, there would have been no rationale behind the operation of specific start-up processes involving lengthy steps such as those

disclosed in the prior art (e.g. D4) in the first place, if the operational selectivity of the catalyst were not at stake. Hence, the appellant's allegation is without basis.

5.2.5 The appellant also argued that "high selectivity" was an arbitrary, undefined and subjective term. It was therefore not appropriate to include it as a part of the objective technical problem underlying claim 1.

5.2.6 The board disagrees. "High selectivity" in the objective technical problem means high selectivity relative to the closest prior art, i.e. that the obtained selectivity in operation should be comparable to that of the closest prior art. Hence, the argument that this term cannot be part of the objective technical problem is without merit.

5.3 Obviousness

5.3.1 The appellant argued that the claimed subject-matter lacked inventive step in view of D1 alone, or in view of D1 in combination with D4 or D8.

5.3.2 First, in relation to D1 alone, the appellant argued that in view of the lack of any technical effect, the claimed subject-matter represented a mere arbitrary variation in the process steps of claim 1.

5.3.3 The board disagrees. As stated by the respondent, the various steps in a start-up procedure for an epoxidation catalyst are interlinked, i.e. have an effect on each other. There is no indication in D1 that high selectivity in operation could be achieved by arbitrarily changing the steps of the start-up process. Rather, the skilled person would understand the prior

art start-up processes, including that of D1, as stand-alone processes comprising a set of specific steps. The skilled person would not consider that an alternative process to that of D1 reaching a high level of selectivity at operational level could be obtained by adjusting the steps of the process of D1 in the manner carried out in claim 1. Hence, the claimed subject-matter involves an inventive step over D1 alone.

- 5.3.4 Second, the appellant argued that claim 1 merely represented an arbitrary variation of the start-up procedure disclosed in D1, by introduction of some of the process steps applied in D4 or D8.
- 5.3.5 Patent document D4 also concerns an epoxidation start-up process employing a selective silver-based catalyst (page 1, lines 8-11). In example 2, a silver epoxidation catalyst was charged into a microreactor. The catalyst temperature was increased to 225 °C, and a feed gas composition comprising oxygen/ethylene/carbon dioxide/nitrogen in a volume ratio of 4:15:4:77 as well as 2.6 ppmv ethyl chloride (chloride moderator) was added. These conditions were maintained for 2 hours (D4, page 25, line 30 - page 26, line 16). The catalyst was then subjected to the conditions set out in the table on pages 26 and 27 of D4. Although the table illustrates the conditions for example 1, it is stated that example 2 was carried out as example 1, except for the application of an ethyl chloride concentration of 3.0 ppmv in steps 4-14 (D4, page 28, lines 1-3).
- 5.3.6 Hence, for example 2 of D4, the table on page 27 of D4 discloses that:

- after the initial heating to 225 °C (in step 1 of the table in D4), the catalyst was further heated, to 235 °C in step 2,
- in step 3 the catalyst temperature is not provided; rather it is stated that the catalyst temperature was adjusted so as to obtain and maintain 3.1 %v ethylene oxide in the reactor outlet stream (table, page 26, text below step 3),
- in steps 4 to 14, the ethyl chloride concentration was increased from 2.6 ppmv in steps 1 to 3, to 3.0 ppmv,
- also in steps 4 to 14, the temperature was sequentially increased with each step, from an initial 245 °C (step 4) to 270 °C (step 14),
- in steps 15-17, the temperature was lowered to 250 °C,
- also in steps 15-17, the ethyl chloride concentration was decreased from 3.0 ppmv to 1.2, 1.8 and 2.2 ppmv respectively,
- from step 15, the feed composition was changed to oxygen/ethylene/carbon dioxide/nitrogen in a volume ratio of 8:30:2:60.

5.3.7 In relation to the relevance of D4 in combination with D1 as closest prior art, the appellant argued that the possibility of applying a chloride reducing step as set out in claim 1 (one of the distinguishing features over closest prior art document D1) was already known from the start-up procedure of D4 whereby the chloride moderator concentration is reduced from 3.0 ppmv in step 14 to 1.2 ppmv in step 15. Hence, claim 1 amounted to a mere arbitrary combination of known elements from the prior art into a single start-up process.

5.3.8 The board disagrees. As stated above, the various steps in a start-up procedure for an epoxidation catalyst are interlinked, i.e. have an effect on each other. For this reason, quite specific start-up procedures such as that disclosed in D4, which consists of a series of specific steps, lead to high selectivity in operation. There is no indication in D1 or D4 that high selectivity in operation could also be achieved by arbitrarily combining some features or steps of a process from one specific known start-up process such as D1, with features or steps from another known start-up process such as D4. Rather, the skilled person would understand the prior art start-up processes as stand-alone processes from which features or process steps could not be simply isolated and parachuted into other known processes.

5.3.9 Furthermore, as noted by the respondent, a combination of the teachings of D1 and D4, even if it would have been implemented by the skilled person, would still not have led to the subject-matter of claim 1. Specifically, the reduction of the chloride moderator concentration in step 15 of example 2 (table, page 27) of D4 is also accompanied by a further change in the feed gas (see table, footnote). As set out above, claim 1 is to be interpreted such that in the chloride reducing step, with the exception of the reduction in the chloride moderator concentration, the concentration of the feed remains unchanged. Since however as set out above, the feed composition was changed in step 15 of example 2 of D4, at least this requirement is not met. Hence, even combining individual steps of the processes of D1 and D4 would not lead to the claimed subject-matter.

5.3.10 Patent document D8 was cited by the appellant in the same context as D4 as a combination document with D1 as closest prior art. Similarly, the appellant argued that D8 disclosed the chloride reducing step of present claim 1, and hence in the same manner as for D4, would lead the skilled person to the claimed subject-matter.

5.3.11 The board notes however that D8 does not disclose such a chloride reducing step, in particular subsequent to a maintaining step as required by claim 1. Specifically, in the process according to D8, the initial chloride moderator (ethyl chloride) concentration was 2.5 ppmv (page 28, lines 4-19). Then a different gas mixture was passed through the catalyst beds and the temperature was increased to 260 °C for 24 hours (page 28, lines 20-24). The gas composition during this heat treatment is provided in table I (page 29). The chloride moderator concentration is provided as zero (example 2), 0.5 ppmv (example 3), or "trace" (example 4). After heat treatment, *inter alia* the ethyl chloride concentration was readjusted to 1.5 ppmv (page 28, lines 23-28). Hence, D8 discloses a temperature maintaining step (the heat treatment) followed by an *increase* in the amount of the chloride, which is in direct contradiction with the requirements of present claim 1. Hence, even if the skilled person were to combine D1 with D8, it would not lead to the claimed subject-matter.

5.3.12 For these reasons, the subject-matter of claim 1 involves an inventive step starting from D1 as closest prior art.

6. Inventive step starting from D4

The appellant argued that the claimed subject-matter lacked inventive step starting from example 2 of D4, which is described in detail above.

6.1 Distinguishing features

6.1.1 In written appeal proceedings the appellant submitted an analysis of D4 *inter alia* according to which steps 4 to 14 of example 2 thereof (table on pages 26 to 27) corresponded to the maintaining step of present claim 1 (grounds of appeal, page 21, third paragraph). Specifically, in those steps, the temperature was gradually raised from 245°C to 270°C, and therefore "maintained" in the range of the second temperature according to present claim 1.

6.1.2 In view of the board's interpretation of the term "maintaining" in claim 1 provided above as referring to a fixed specific temperature, this interpretation fails from the outset.

6.1.3 A new analysis of example 2 of D4 was put forward by the appellant during oral proceedings before the board.

6.1.4 According to this analysis:

- step 1 of example 2 was the initiating step of claim 1;
- steps 2 to 13 were the increasing step of claim 1;
- step 14 was the maintaining step of claim 1;
- step 15 was the chloride reducing step of claim 1;

- steps 18-21 were the temperature reducing step of claim 1: the temperature was reduced to about 246°C - see page 28, lines 7 to 10.

- 6.1.5 The appellant conceded that in step 15 of example 2, corresponding to the chloride reducing step of claim 1, the feed gas was changed (see footnote to the table). Such a change in the feed gas was excluded by claim 1: the chloride reducing step involved only a reduction in the concentration of the chloride modifier in the feed gas composition used in the previous steps. This was therefore the distinguishing feature of claim 1 over example 2 of D4.
- 6.1.6 The board however agrees with the respondent's position that there are further distinguishing features.
- 6.1.7 First, in step 3 of example 2 (table, page 26), a catalyst temperature is not provided. Rather it is stated (table, footnote) that the catalyst temperature was adjusted during this step so as to obtain and maintain 3.1 %v ethylene oxide in the reactor outlet stream. It thus cannot be excluded that step 3 involves a decrease in temperature. Therefore, steps 2 to 13 of example 2 do not unambiguously disclose a temperature increasing step according to claim 1.
- 6.1.8 Second, step 14 of example 2 differs from the maintaining step of claim 1 in that this temperature is maintained for 5 hours, while claim 1 requires that the second temperature is maintained over a time period of from about 10 hours to about 400 hours. Hence, example 2 of D4 fails to disclose a maintaining step as required by claim 1.

6.1.9 Third, the temperature of "about 246°C" for the temperature reducing steps 18-21 of example 2 does not amount to a direct and unambiguous disclosure of a third temperature of from 180°C to 245°C as required by the temperature reducing step of claim 1. Rather, the temperature could be slightly above or below 246°C, but not necessarily and inevitably 245°C, or below. Furthermore, as stated by the respondent, steps 18 to 21 of example 2 also involve an increase in the chloride moderator concentration of from 2.2 to 3.0 ppmv, which is not a feature of the temperature reducing step according to claim 1.

6.1.10 Consequently, there are four features distinguishing the subject-matter of claim 1 from example 2 of D4.

6.2 Objective technical problem

6.2.1 In a similar manner as set out above starting from D1 as closest prior art, the appellant submitted that the objective technical problem was the provision of a mere alternative to the start-up process of D4.

6.2.2 For the same reasons as provided in relation to the formulation of the objective technical problem starting from D1, the board disagrees. As argued by the respondent, the effect of the distinguishing features is that an alternative process was provided with high selectivity during operation. Hence the objective technical problem is the provision of an alternative process reaching a high level of selectivity at operational level.

6.3 Obviousness

6.3.1 The appellant argued that the claimed subject-matter lacked inventive step in view of D4 alone, since the distinguishing features amounted to a non-inventive selection amongst a number of known possibilities, i.e. minor trivial changes to the process of D4 for which the skilled person would expect a similar selectivity in operation.

6.3.2 The board disagrees for similar reasons to those provided above in relation to D1. Specifically, the various steps in the start-up procedure are interlinked, i.e. have an effect on each other. For this reason, start-up procedures such as that disclosed in D4, which consist of a series of specific steps, lead to high selectivity in operation. By changing the steps of the start up process of D4 as set out above, the skilled person would not expect to maintain high selectivity in operation.

6.3.3 Consequently, the subject-matter of claim 1 involves an inventive step starting from D4.

6.4 It follows that the ground for opposition under Article 100(a) EPC in combination with Article 56 EPC does not prejudice maintenance of the patent as granted.

7. Since there were no further objections, the appeal is to be dismissed.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:



U. Bultmann

M. O. Müller

Decision electronically authenticated