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**Datasheet for the decision
of 10 February 2010**

Case Number: T 0520/05 - 3.3.07

Application Number: 95943625.4

Publication Number: 0794833

IPC: B01J 23/50

Language of the proceedings: EN

Title of invention:
Silver catalyst preparation

Patent Proprietors:
Scientific Design Company Inc.

Opponents:
THE DOW CHEMICAL COMPANY

Headword:

-

Relevant legal provisions:
EPC Art. 54, 56

Relevant legal provisions (EPC 1973):

-

Keyword:

"Novelty (no) (main request)"
"Inventive step (no) - obvious combination of known features
(all auxiliary requests)"

Decisions cited:

-

Catchword:

-



Case Number: T 0520/05 - 3.3.07

DECISION
of the Technical Board of Appeal 3.3.07
of 10 February 2010

Appellants:
(Opponents)

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Decision under appeal:

Interlocutory decision of the Opposition
Division of the European Patent Office posted
25 February 2005 concerning maintenance of
European patent No. 0794833 in amended form.

Composition of the Board:

Chairman: S. Perryman
Members: B. ter Laan
F. Rousseau

Summary of Facts and Submissions

- I. The appeal by the opponents lies against the decision of the opposition division posted on 25 February 2005 to maintain European patent No. 0 794 833 in amended form.
- II. The patent was based on European application No. 95 943 625.4, originating from international patent application PCT/US95/15568 (filed on 29 November 1995 and published on 6 June 1996 under No. WO 96/16734).
- III. The patent was granted on the basis of three claims, independent claim 1 reading:

"1. ~~In~~ A process for the preparation of a supported silver catalyst suitable for use in the oxidation of ethylene to ethylene oxide wherein an inert support is impregnated with a silver/amine solution and calcined, **and where** ~~the improvement which comprises heating the impregnated support~~ **is heated** to 300-500°C for a time sufficient to convert the silver to metallic silver and to decompose and remove organic materials, the impregnated support being maintained under an inert gas atmosphere **which is substantially free of oxygen while** at temperatures of 250°C or higher **and during the entire period of calcination.**"

(deletions vis-à-vis the original claim are indicated by the Board in strikethrough, additions in bold)

- IV. A notice of opposition against the patent was filed on 26 November 2002, in which the revocation of the patent in its entirety was requested on the grounds of

Article 100(a) EPC (lack of novelty as well as lack of an inventive step), and Article 100(c) EPC (added subject matter).

The opposition was supported by:

- D1 US-A-4 690 913,
- D2 US-A-4 837 194,
- D3 US-A-4 471 071
- D4 US-A-4 908 343
- D5 US-A-4 374 260
- D6 US-A-4 389 338 (introduced after the nine months opposition period).

V. The decision under appeal was based on the claims as granted (main request) and a first auxiliary request of three claims, with corresponding amendments to the description. The opposition division decided that the main request was not novel over D2, but that the first auxiliary request complied with the requirements of Articles 123(2) and (3) EPC as well as Articles 83 and 84 EPC and was both novel and inventive. Claim 1 of the first auxiliary request read:

"1. ~~In~~ A process for the preparation of a supported silver catalyst suitable for use in the oxidation of ethylene to ethylene oxide wherein an inert support is impregnated with a silver/amine solution and calcined, **and where** ~~the improvement which comprises heating the impregnated support~~ **is heated** to 300-500°C for a time sufficient to convert the silver to metallic silver and to decompose and remove **the** organic materials, the impregnated support being maintained under an inert gas atmosphere **which is substantially free of oxygen while**

at temperatures of 250°C or higher **and during the entire period of calcination.**"

(deletions vis-à-vis the original claim are indicated by the Board in strikethrough, additions in bold)

- (a) The opposition division held that D2 disclosed a process including impregnation followed by calcination of a support, and subsequently a secondary process in air to remove residues left after the calcination. As the claimed process did not require that all residues be removed during calcination, the process of D2 contained all the features of the claimed process of the main request, which was therefore not novel.
- (b) In the first auxiliary request the word "the" before organic materials found its support in the original description. It was also clear in that its presence indicated the removal of all organic material. The method exemplified in the description resulted in the effective absence of organic residue after calcination, so that Article 83 EPC was also complied with. The claimed process was novel as the removal of all organic residue had not been disclosed in D2, according to which a second process step was required in order to do so. D1 disclosed calcination in super-heated steam, which was not an inert atmosphere. Novelty was accepted.
- (c) The claimed process was also inventive as D1 did not hint at any other atmosphere than superheated steam and D2 did not suggest the possibility or

necessity of removing all residues during calcination. The other documents on file disclosed air as the preferred calcination atmosphere and hence did not teach to avoid oxygen and to use an inert atmosphere.

VI. On 26 April 2005 the opponents (appellants) lodged an appeal against the above decision. The prescribed fee was paid on the same day. The statement setting out the grounds of appeal was filed on 23 June 2005. Further arguments and an experimental report were submitted by the appellants with letter of 14 July 2009. In response to the respondents' (patent proprietors') letter of 9 January 2010, a letter dated 4 February 2010 was filed regarding the admission of late requests into the proceedings.

VII. By letter dated 22 December 2005 the respondents filed comments on the grounds for the appeal as well as a declaration by Mr N. Rizkalla containing experimental evidence. In response to the letter of the appellants dated 14 July 2009 and to a communication by the Board dated 23 October 2009, further comments were given by letter dated 9 January 2010, with which 11 auxiliary requests were also filed. Copies of decisions by the Boards of Appeal, of a decision of the USPTO Board of Patent Appeals, an extract of the Oxford English Dictionary as well as a further patent document were attached. Further comments, concerning the admissibility of the submissions of 9 January 2010, were filed by fax dated 8 February 2010.

VIII. Oral proceedings before the Board were held on 10 February 2010. After an elaborate exchange of

arguments, the respondents filed four new sets of 1 claim each as auxiliary requests I to IV, replacing all other previous auxiliary requests.

The only claim of auxiliary request I read:

"1. ~~In~~ A process for the preparation of a supported silver catalyst suitable for use in the oxidation of ethylene to ethylene oxide wherein an inert support is impregnated with a silver/amine solution and calcined, **and where** ~~the improvement which comprises heating the impregnated support~~ **is heated** to 300-500°C for a time sufficient to convert the silver to metallic silver and to decompose and remove **the** organic materials, the impregnated support being maintained under an inert gas atmosphere **which is substantially free of oxygen while** at temperatures of 250°C or higher **and during the entire period of calcination,** wherein the inert gas is nitrogen, an inert atmosphere being maintained in contact with the silver containing support both during the period when the impregnated support is heated to and maintained at 300°-500°C, and during cooling of the calcined catalyst from 300°-500°C to 100°C or lower, and contact of the silver-containing support with an oxygen containing atmosphere at temperatures in excess of 100°C being avoided."

Compared to auxiliary request I, auxiliary request II defined the silver catalyst prepared in the claimed process so as to comprise cesium; auxiliary request III required that the silver catalyst comprised rhenium as

a co-promoter; and auxiliary request IV specified that the process should comprise the step of:

"... heating in a furnace having several heating zones in a controlled atmosphere, the atmosphere of the furnace being controlled through flow of nitrogen to the different heating zones, nitrogen being passed upwardly through the catalyst in each zone to aid in the removal of volatiles and to provide an atmosphere essentially free of oxygen."

(additions vis-à-vis the original claim are indicated by the Board in bold)

IX. The appellants' arguments can be summarised as follows:

- (a) A great number of auxiliary requests had been filed by the respondents at such a late stage of the proceedings that the appellants had had less than a month time to prepare a reaction. The late filing of so many requests contravened the Rules of Procedure of the Boards of Appeal (RPBA), which were designed to prevent such a situation. Replacing those requests by four further requests filed during the oral proceedings before the Board also contravened Article 13(3) RPBA. The new requests introduced new issues that could not have been expected and there had been no opportunity to consider e.g. experiments to counter some of the Respondent's arguments. Also, there had been no change in the issues so that there was no reason for the late filing of the requests, which amounted to an abuse of procedure and should therefore not be admitted into the proceedings.

- (b) As to the main request, Article 123(2) EPC was not complied with. The original application did not contain any support for the inert atmosphere being "substantially free of oxygen". It was not clear if that meant the same thing as the expression "essentially free of oxygen", which had been originally disclosed. Reference was made to decision T 1842/07 (11 November 2008).

Also, there was no basis for the requirement that the inert gas atmosphere should be maintained during the entire period of calcination, since calcination could start at temperatures lower than the temperature ranges indicated in the original description.

Furthermore, the addition of "the" before organic materials had no basis for the interpretation given to it in the decision under appeal that all organic material should be removed. In that interpretation, Article 83 EPC was also not complied with as it was not clear how one removes all organic material. If "the" had no particular meaning, then its presence rendered the claim unclear (Article 84 EPC). The same was valid for the expression "or lower" regarding the cooling of the catalyst, which caused unclarity about the point in time when calcination was finished. Usually, calcination was considered to be finished when a useful catalyst was produced.

- (c) D2 disclosed the same process steps as the patent in suit, disclosing heating and implying cooling

under nitrogen, for preparing a catalyst that was suitable for use in the oxidation of ethylene to ethylene oxide. Depending on the interpretation of the word "the" before "organic materials", different objections were raised. If it meant that only some organic material was removed, then the claim did not comply with Article 54 EPC since the same process steps were disclosed in D2. If, however, it meant the removal of all organic materials, as the opposition division believed, the requirements of Article 83 EPC were not met since the conditions according to the patent in suit still left some residue and it was not indicated how to remove all of it.

Assuming that the entire calcination was meant to be carried out in an inert atmosphere: with the first step of the process described in D2 a useful catalyst was produced so that at that point the calcination was finished, meaning that the whole calcination had been carried out under an inert atmosphere, so that all the claimed process steps were disclosed.

- (d) Also D1 and D3 disclosed all the features of the claimed process. D1 described a heat treatment under superheated steam which was substantially free of oxygen. Organic residues were just as well removed under superheated steam as under nitrogen. Therefore, the claimed subject-matter was not novel. D3, D4 and D5 mentioned calcination under air, but also under nitrogen or carbon dioxide.

- (e) As to inventive step, starting from D2, no effect had been shown due to the process steps claimed so that the problem to be solved was to provide a mere alternative. That was obvious since it only involved a choice out of two possibilities: the use of air or an inert gas. The process claimed in the main request was a normal way to carry out calcination and no technical effect had been identified at all. Therefore, the claimed process was not inventive.

- (f) Regarding the auxiliary requests, additional objections were raised under Article 123(2) EPC since the specific combination of features had no proper basis in the original application. Furthermore, auxiliary request 4 did not comply with Article 123(2) since the patent specification contained details not present in the claim.

- (g) The arguments concerning the lack of an inventive step of the main request also applied to auxiliary requests 1, 2 and 3. Apart from that, auxiliary requests 2 and 3 defined the use of known (co)promoters that could not render the claimed process inventive anyway.

Regarding auxiliary request 4, the prevention of explosions as the problem to be solved had not been an issue in the application as filed and could therefore not be taken into account. The detailed combination of features according to auxiliary request 4 did not seem to solve any particular problem at all.

As the processes claimed in the auxiliary requests did not contribute anything to known calcination processes, the auxiliary requests, too, lacked an inventive step.

X. The arguments of the respondents can be summarized as follows:

- (a) After the respondents' reaction to the statement of grounds for the appeal, the appellants had not filed any reply anymore. Therefore, there had been no reason to consider amendments to the claimed subject-matter. The new requests were in direct response to the Board's preliminary opinion and should therefore be admitted into the proceedings.
- (b) Regarding the main request, several passages in the original application offered support for the introduction of the requirement that the inert atmosphere should be substantially free of oxygen, which had the same meaning as essentially free of oxygen. Reference was made to T 343/90 (26 May 1992). According to the original application and claims, "inert atmosphere" meant oxygen-free.

As regards the "entire period of calcination", calcination took place between 300 and 500°C, and also included a possible second heating step, in accordance with the original disclosure.

The introduction of "the" before organic materials was also based on the original disclosure; it had been introduced in order to overcome a lack of novelty over D2. Removing all the organic material

was however not the focus of the invention and it should be read in the technical sense. The skilled person knew what was meant.

Since all amendments found their basis in the original application, the requirements of Article 123(2) EPC were complied with. Regarding Article 83 EPC, the burden of proof lay with the opponents who had not shown that the claimed process could not be carried out.

- (c) As to novelty, D2 described a second calcination step in the presence of air. Therefore, the entire calcination was not carried out in an inert atmosphere. D2 described the presence of a substantial amount of organic residue after the heating step, which was not the case in the claimed process. Also, in order to obtain the ready catalyst, several more steps were required according to D2, which accordingly used the term "precursor". Since the present claims referred to a catalyst, not a precursor, the difference was clear.

D1 described a process in which superheated steam was used, which was not an inert, oxygen-free atmosphere. In D3, in all examples air was used and the absence of oxygen was not described. In fact, air was seen as an inert atmosphere. In order to arrive at the claimed subject-matter, several selections out of D3 were necessary. The same applied to D4 and D5, both describing air as the calcination atmosphere and requiring several

selections in order to arrive at the claimed process.

- (d) As to inventive step, starting from D2, the problem to be solved was to improve the activity of the catalyst, which also had a different morphology. The absence of oxygen during heating as well as cooling was essential to achieve that. The absence of oxygen prevented, beside the risk of explosions, local heating of the catalyst precursor at the level of the silver due to burning of the organic residues, so that without oxygen a better control of the calcination temperature was possible. D2 did not suggest that. D2 did not describe that the catalyst was cooled between the two steps. The better control of the calcination according to the process now being claimed allowed an improved process for the preparation of the catalyst as well as a catalyst with improved performance, as confirmed by the examples in the patent in suit. D2 did not teach to avoid oxygen during cooling to such low temperatures.

The other documents on file considered air as an inert atmosphere, so that it was not obvious from those documents either to avoid the presence of oxygen during calcination, including cooling. The presence of oxygen had not been seen as a problem in any of the documents.

- (e) The arguments given for the main request also applied to the auxiliary requests. Moreover, a number of features, such as nitrogen as the inert

gas and the temperatures for calcination and for the avoidance of oxygen, were specified. The processes according to auxiliary requests 2 and 3 contained an additional (co)promoter as a further distinguishing feature. D2 only taught to use an alkali metal.

Auxiliary request 4 described the heating in more detail. By means of the controlled calcination in accordance with the claimed process, the disadvantages and risks of calcination were avoided, which was not taught in any of the cited documents.

Therefore, the auxiliary requests were also inventive.

XI. The appellants requested that the decision under appeal be set aside and the patent be revoked.

The respondents requested that the appeal be dismissed or that the decision under appeal be set aside and the patent be maintained on the basis of one of auxiliary requests I to IV as submitted at the oral proceedings on 10 February 2010.

Reasons for the Decision

1. The appeal is admissible.

Admissibility of late filed requests

2. During the oral proceedings four new auxiliary requests were filed. They were a direct reaction to the arguments brought forward by the appellants and the preliminary opinion expressed by the Board, in particular in view of the interpretation of the word "the" before "organic materials", to which the Board gave a different meaning than the opposition division had done (see point 3.1 below). Hence, there is no question of an abuse of procedure, nor is Article 13(3) RPBA contravened. Since the four new auxiliary requests were filed in order to overcome objections under Articles 54 and 56 EPC regarding the main request, Rule 80 EPC is also complied with. The amendments did not amount to such complex issues that no decision could be taken at the end of the oral proceedings and the appellants had and used the opportunity to comment upon the requests during the oral proceedings. The new requests did introduce new issues that could not have been foreseen, but in view of the outcome of the appeal, there was no need for the appellants to file experiments to counter some of the respondents' arguments. Therefore, the Board decided to admit the new requests into the proceedings.

Main request

Amendments

3. Claim 1 of the main request, which is the claims as maintained by the opposition division, contains one addition vis-à-vis claim 1 as granted: the word "the" before "organic materials". The basis for that can be found on page 6, lines 13 to 14: "... and to decompose the organic materials and remove the same as

volatiles." Article 123(2) EPC is therefore complied with.

- 3.1 As regards the meaning of that addition, the respondents argued that it implied that all organic materials were removed, which argumentation had been followed by the opposition division.

In the application as originally filed, the removal of organic materials is described on page 2, lines 19 to 20, page 6, lines 13 to 14 and page 9, line 9, as the removal of "volatiles". No further indication is present regarding the presence or absence of organic material after calcination. There is no suggestion that all organic material should be or in fact is removed during calcination and no measurements regarding organic residues are given. Hence, there is no indication that the absence of organic material after calcination is an essential feature of the invention so that any interpretation in that sense cannot be read into the claim. Therefore, the patent in suit does not support the interpretation (the removal of all organic materials) given by the respondents and the opposition division to the presence of the word "the" before "organic materials" in claim 1. As a consequence, claim 1 of the main request has the same meaning as claim 1 as granted. Article 123(3) EPC is therefore also fulfilled.

- 3.2 Since the addition of "the" caused some discussion and the opposition division found it necessary to give an interpretation of its meaning, it is doubtful whether Article 84 EPC is complied with. However, as the claim

is not novel anyway (see point 4 below), that question needs not be decided.

Novelty

4. D2 discloses a process of improving the performance of a catalyst for the production of alkylene oxides by the reaction of the corresponding alkene with oxygen which comprises silver supported on an α -alumina support which comprises introducing an alkali metal selected from lithium, sodium, rubidium, and/or potassium to the catalyst in a ratio of one part chemically absorbed to at most three parts physically deposited, by contacting the catalyst with a solution or colloidal solution of a compound of lithium, sodium, rubidium, and/or potassium in a solvent which has a dielectric constant of at most 8 at 20°C (claim 1).

The silver may be introduced to a pre-formed porous heat-resisting support as a suspension of silver or silver oxide in a liquid medium, for example water, or by impregnation of the support with a solution of a silver compound which can be reduced to silver metal. If necessary, the silver compound may be decomposed to silver by heating in the range of 100 to 350°C, for example for a period of 15 minutes to 24 hours, preferably in the substantial absence of oxygen, for example in the presence of an inert gas for example nitrogen (column 3, line 36 to column 4, line 29).

In Examples 1 to 8 (Preparation of the catalysts; columns 5 and 6), the catalyst was prepared by impregnating support pellets with a silver nitrate/monoisopropylamine complex solution and then heating in

nitrogen gas at a temperature beginning at 100°C and increased to 300°C over 18 hours. The impregnated complex decomposed to leave evenly dispersed particulate silver on the surface of the pellets which also contained a residue of carbon and nitrogen containing substances. A second step in air beginning at 5% air-in-nitrogen at 150°C, slowly increased to 100% air and 300°C, was then carried out, resulting in silver-coated pellets substantially free of the residues remaining from the anaerobic decomposition process. Those are then washed, cooled and dried, the product being indicated as a "precursor". The silver is evenly distributed on the internal and external surfaces of the porous α -alumina pellets (column 6, lines 4 to 6).

4.1 In order for the present process to be novel, it should not encompass the process described in D2.

4.1.1 There can be no doubt that the heating step of D2, carried out in nitrogen gas at a temperature beginning at 100°C and increased to 300°C over 18 hours, falls under any of the notions of "substantially free of oxygen" and "essentially free of oxygen", so that that feature cannot constitute a difference with the process of D2, regardless of whether those expressions have exactly the same meaning or not.

4.1.2 The respondents argued that in the process of D2 after the heating under nitrogen, organic residues were still present, which was not the case in the present process.

However, the Board fails to see why the first step of the process described in D2, which leads to the

presence of particulate silver on the support (column 6, lines 4 to 7), and which is fully covered by the terms of the present heating step, would lead to a different result; in other words, why in the process of D2 organic residues are still present, whereas that would not be the case in the present process. Claim 1 does not define any difference between the claimed process and that of D2 that might cause the removal of all organic residues, nor did the respondents, when asked, give any possible explanation for it during the oral proceedings.

Since claim 1 of the main request does not exclude the presence of any organic residue after calcination, that cannot constitute a difference with D2.

- 4.1.3 The respondents also argued that in D2 the inert gas atmosphere was not maintained during the entire period of calcination since in D2 cooling and a second calcination step were carried out in air.

Claim 1 of the main request requires that the impregnated support be maintained in a substantially oxygen-free atmosphere at temperatures of 250° or higher and during the entire period of calcination. A definition of "period of calcination" is not given. According to the patent specification (paragraph [0006]), the impregnated support is calcined at a temperature in the range of about 300°C to 500°C for a time sufficient to reduce the silver component to metallic silver and to remove volatile decomposition products from the silver containing support. In paragraph [0015] it is stated that the calcination is accomplished by heating to 300-500°C for a time

sufficient to convert the silver to silver metal and to decompose the organic materials and remove the same as volatiles. In paragraph [0023] calcination is defined as the deposition of silver compound, induced by heating to the decomposition temperature of the silver salt. That information may be summarized to defining calcination as heating the silver catalyst to a temperature at which the silver is reduced to metal and organic material is removed as volatiles; that is confirmed by Mr Rizkalla's declaration of 19 December 2005 containing experiments, in which calcination is defined as the deposition of silver compound, induced by heating the catalyst up to the decomposition temperature of the silver salt (page 3, "The calcination process"). Therefore, the essence of calcination is the deposition of silver particles. There is no requirement that all organic material should be removed, so that the second step of D2, which only concerns the removal of carbon and nitrogen containing residues, cannot be considered to be part of the calcination process within the meaning of the patent in suit.

In that light, no special meaning can be attributed either to the use of the word "precursor" for the product of the first heating step of D2 in the sense that it would not be suitable for the oxidation of ethylene to ethylene oxide, as the respondent argued.

Furthermore, present claim 1 does not exclude that a second step is carried out after calcination, e.g. in order to remove organic residues.

For those reasons, the requirement in present claim 1 that substantially no oxygen should be present "during the entire period of calcination" cannot constitute any difference with the process of D2.

4.2 In view of the above, the process of claim 1 of the main request is not novel over D2, so that the main request has to be refused.

5. Since the claimed subject-matter is not novel over D2, there is no need to go into the question whether it is also not novel over D1.

Auxiliary request I

Amendments

6. Claim 1 of auxiliary request I has, compared to the main request, the additional requirements that the inert atmosphere should be nitrogen, that it should be maintained in contact with the silver containing support both during the period when the impregnated support is heated to and maintained at 300-500°C, and during cooling of the calcined catalyst from 300-500°C to 100°C or lower and that contact of the silver-containing support with an oxygen containing atmosphere at temperatures in excess of 100°C should be avoided. Therefore, the period during which contact with oxygen is to be avoided is defined as the period of heating as from 100°C onward, the period that the temperature is kept between 300 and 500°C and then the period during which the silver containing support is cooled down to 100°C; in short, to avoid contact with oxygen at temperatures above 100°C.

6.1 That interpretation of the claim is in conformity with original description page 2, lines 21 to 25, according to which the avoidance of contact of the silver-containing support with an oxygen containing atmosphere at temperatures above 250°C and preferably in excess of 100°C is indicated to be a critical feature of the catalyst preparation, so that Article 123(2) EPC is complied with.

6.2 The Board is satisfied that the requirements under Articles 84 and 123(3) as well as Rule 80 EPC are also met.

Novelty

7. According to D2 (column 6, lines 3 to 6), the heat treatment of the impregnated complex resulted in its decomposition to leave particulate silver evenly dispersed on the surface of the support pellets, so that the silver has been converted to silver metal and the calcination has been accomplished in accordance with the definition given in the present patent specification. However, although D2 describes the heating in nitrogen gas at a temperature beginning at 100°C (column 5, line 68 to column 6, line 4), there is no mention of cooling the calcined catalyst under an inert atmosphere. After the calcination step under nitrogen at 300°C, the process according to D2 involves a second step starting at 150°C in the presence of increasing amounts of air. Hence, oxygen is added at a temperature of above 100°C, contrary to the requirements of the present process.

In view of the above, present claim 1 is novel over D2.

- 7.1 According to D1 the calcination is carried out in superheated steam, which is not nitrogen. The other documents on file in particular describe and exemplify calcination atmospheres containing air. Therefore, the claimed process is also novel over those documents.

Inventive step

8. The patent in suit concerns a process for the preparation of a supported silver catalyst useful for the vapour phase oxidation of ethylene to ethylene oxide. Such a process is known from D2, which the parties considered to be the closest prior art document. The Board sees no reason to deviate from that view.

- 8.1 According to the patent specification, the problem to be solved is to provide an improved preparation process (paragraph [0006]). It is however not stated in which respect the process should be improved. The only comparison presented by the examples refers to a calcination process that is entirely carried out in air, thus not reflecting the process of the closest prior art document D2 according to which a first heating step under nitrogen is carried out. Therefore, any differences in catalyst properties such as a higher activity and a different morphology have not been shown to be caused by the difference between the present process and that of D2. The alleged process advantages mentioned by the respondents during the oral proceedings, such as a better control of the calcination process reducing the risk of explosions, are not mentioned in the patent in suit and can hence

not be taken into account. Moreover, there is no evidence that those advantages are effectively achieved by avoiding oxygen contact of the catalyst at temperatures above 100°C. Therefore, the problem effectively solved by the present process can only be seen as to provide a further, or at most a simpler process for preparing a catalyst such as described in D2.

8.2 The question remains to be answered if it was obvious for the skilled person to avoid oxygen contact of the catalyst over the whole period during which the temperature is above 100°C with a view to solving the above-defined problem.

8.2.1 All the documents on file describe processes for producing a silver catalyst by impregnation of a porous carrier with a silver compound and then heating the impregnated carrier in order to reduce and deposit the silver on the carrier.

8.2.2 In D1 the heat treatment is carried out under superheated steam (claim 6) which has a temperature of 120°C to 500°C, in particular 150°C to 260°C (column 10, lines 24 to 26) and into which nitrogen may be included (column 10, lines 47 to 48).

D2 describes calcination at 300°C under nitrogen and a second heating step during which air is gradually added (see point 4 above).

According to D3, the heating step at 170°C to 400°C, in particular 200°C to 350°C, can be carried out in a hot inert gas such as air (*sic*), nitrogen, carbon dioxide

or a mixture thereof, or superheated steam (column 6, lines 38 to 53). In the examples air was allowed to flow upwards through a tube and nitrogen was blown in at a point about 50 mm above the support to be reduced, to prevent a possible explosion.

In D4 the heat treatment at 100°C to 900°C, in particular 200°C to 700°C, is preferably carried out in air, but a nitrogen or carbon dioxide atmosphere may also be used (column 18, lines 15 to 24 and 49 to 51).

According to D5 the heating step at above 180°C, in particular 200°C to 300°C, may be carried out in air or in an inert atmosphere (column 7, lines 26 to 30).

The heat treatment in D6 involves a temperature in the range of 550°C to 950°C in an inert gaseous atmosphere having an oxygen concentration of not more than 3 volume percent in the final step (claim 1), preferably not more than 0.1 volume percent (claim 3). Inert gases include nitrogen, helium, argon, carbon dioxide and neon, the first three being preferred, in particular nitrogen for practical reasons (claims 4 and 5 and column 5, lines 12 to 17).

8.2.3 From the above it appears that it is known to carry out the heating step under several different possible atmospheres such as air or nitrogen, or both. None of the documents mentions particular circumstances for the cooling step, i.e. for the complete period during which the catalyst has a temperature above 100°C. With the exception of D2, none of the other documents mentions a change of atmosphere during cooling from the one used during heating, thus implying that the atmosphere is

not changed during the whole period of heating and cooling. In D2, it is explicitly indicated that a second heating step is carried out in an atmosphere that is gradually changed in order to remove organic residues. Therefore, if the heating is carried out in a certain atmosphere, there is no reason to take the trouble to change that unless in order to achieve a certain result. In that light, there is nothing special in maintaining the atmosphere under which the heating has been carried out also during cooling.

8.2.4 Furthermore, D3, D4, D5 and D6 all disclose that calcination may be also carried out in an inert atmosphere such as nitrogen so that the use of nitrogen instead of air as the calcination atmosphere is a serious option according to those documents.

8.2.5 In view of the foregoing, it cannot be considered inventive for a skilled person to maintain a nitrogen atmosphere when, starting from D2, the desired result is merely a further or a simpler process to produce a silver catalyst suitable for the vapour phase oxidation of ethylene to ethylene oxide.

Auxiliary request II

Amendments

9. Compared to Auxiliary request I, Auxiliary request II requires the additional presence of cesium in the silver catalyst.

The addition of cesium as a catalyst promoter is disclosed on original page 5, line 25. As it is a

restriction and there can be no doubt about what is meant, Articles 123(2), 123(3) as well as 84 EPC are complied with.

Inventive step

10. Since the temperature requirements of the present process are the same as that of auxiliary request I, D2 may still be considered to be a proper starting point for assessing inventive step. As no effect has been shown to exist that can be attributed to the combined presence of cesium and avoiding oxygen contact at temperatures above 100°C, the problem actually solved by the claimed process is seen as to provide a further method for preparing a catalyst according to D2.

10.1 Since both measures are to be seen as independent from each other, i.e. as aggregate features, the considerations regarding inventive step of auxiliary request I also apply to auxiliary request II in so far as the temperature requirements of the process are concerned.

It remains to be decided if the addition of cesium is also obvious.

10.2 D2 describes the impregnation of the porous carrier with an alkali metal selected from lithium, sodium, rubidium, and/or preferably potassium (column 1, lines 50 to 64). Cesium is only mentioned in relation to the cited prior art (column 1, lines 28 to 46).

However, cesium is a well-known promoter for silver catalysts suitable for the vapour phase oxidation of

ethylene to ethylene oxide, described, amongst others, in D1 (claim 1, column 5, lines 26 to 58; column 7, line 65 to column 10, line 2; examples), D3 (claim 1, column 4, line 65; examples), D4 (claims 10 to 12), D5 (claim 1, all examples) and D6 (claim 18).

Therefore, it was obvious for the skilled person to add cesium as a promoter to the catalyst of D2 with the object to provide a further process for the preparation of such a catalyst.

Auxiliary request III

Amendments

11. Compared to Auxiliary request I, Auxiliary request III requires the additional presence of rhenium as a co-promoter in the silver catalyst.

The addition of rhenium as a catalyst co-promoter is disclosed on original page 5, line 27. However, a co-promoter is normally not used without a promoter and in fact that passage mentions the use of rhenium in connection with alkali metal promoters such as cesium. Therefore, it is doubtful whether the requirements of Article 123(2) EPC are met.

Inventive step

12. For the same reasons as for auxiliary request II, D2 may still be regarded as the closest prior art document. As no effect due to the combined presence of rhenium and avoiding oxygen contact at temperatures above 100°C has been demonstrated, the same applies as for

Auxiliary request II regarding the problem actually solved by the claimed process: to provide a further method for preparing a catalyst according to D2.

Since both process features are to be seen as independent, i.e. aggregate measures, the considerations regarding inventive step of auxiliary request I also apply to the temperature requirements of the process according to auxiliary request III.

It remains to be decided if the addition of rhenium is also obvious.

- 12.1 Rhenium is a well-known co-promoter for silver catalysts suitable for the oxidation of ethylene to ethylene oxide, e.g. mentioned in D4 (column 8, lines 15 to 36). It was therefore within the normal possibilities for the skilled person to vary the known catalyst of D2 and to use rhenium as a co-promoter with a view to provide a further process for the preparation of a silver catalyst suitable for the oxidation of ethylene to ethylene oxide. Hence, the use of rhenium as a co-promoter for such a catalyst cannot be considered to result in an inventive step.

Auxiliary request IV

Amendments

13. In the only claim of auxiliary request IV, the temperature requirements are the same as in the main request, but now details are given for the heating step, based on the procedures described in examples 1 and 4. Those examples however contain many more details than

now present in the claim, such as temperature and residence time, in combination with a specific composition of the catalyst. It has not been shown that the application as originally filed provides a clear and unambiguous disclosure for the generalisation of the specific examples to which present claim 1 amounts. Therefore, the Board has severe doubts that the claim complies with Article 123(2) EPC.

Inventive step

14. As the heating requirements are the same as in the main request, which was considered to lack novelty over D2, there is no reason to start from any other document than D2, which is therefore still considered to be the closest prior art.
- 14.1 No particular effect is shown to result from the measures now indicated in the claim, so that the problem solved vis-à-vis D2 would still be to provide a further process for preparing a silver catalyst.
- 14.2 The claim requires a furnace having several heating zones in a controlled atmosphere, but no requirements are defined for the temperatures and atmospheres in the various zones, which could therefore be the same. Such a heating means is described in e.g. D3, example 1, in which the soaked and dried catalyst support is packed into a preheated glass tube at 200°C to reduce the silver. Air was allowed to flow upwards and at a higher point, nitrogen was blown in. Therefore, a heating system having at least two zones, which falls under the present claim, was already available in the art and its

application to the process of D2 cannot be seen as inventive.

15. As the main request lacks novelty (Article 54 EPC) and none of the auxiliary requests, apart from having formal problems, are inventive (Article 56 EPC), none of the requests is allowable.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The patent is revoked.

Registrar

Chairman

S. Fabiani

S. Perryman