

Internal distribution code:

- (A) Publication in OJ
(B) To Chairmen and Members
(C) To Chairmen
(D) No distribution

D E C I S I O N
of 16 December 2004

Case Number: T 0001/00 - 3.3.7

Application Number: 93111913.5

Publication Number: 0582165

IPC: B01J 23/78

Language of the proceedings: EN

Title of invention:

Improved catalyst and process for oxychlorination of ethylene to EDC

Patentee:

Oxy Vinyls L.P.

Opponent:

SÜD-CHEMIE AG

Headword:

-

Relevant legal provisions:

EPC Art. 54, 56, 104(1), 111(1), 114(2)

Keyword:

"Novelty and inventive step: with respect to documents D1 to D5 (yes), with respect to late filed document D6 (remittal)"

"Late filed document D6 - admitted"

"Remittal - (yes)"

"Apportionment of costs - (yes)"

Decisions cited:

-

Catchword:

-



Case Number: T 0001/00 - 3.3.7

D E C I S I O N
of the Technical Board of Appeal 3.3.7
of 16 December 2004

Appellant:
(Opponent)

SÜD-CHEMIE AG
Lenbachplatz 6
D-80333 München (DE)

Representative:

Splanemann Reitzner Baronetzky Westendorp
Patentanwälte
Rumfordstrasse 7
D-80469 München (DE)

Respondent:
(Proprietor of the patent)

Oxy Vinyls L.P.
5005 LBJ Freeway
Dallas, Texas 75244 (US)

Representative:

von Kreisler, Alek, Dipl.-Chem.
Patentanwälte
von Kreisler-Selting-Werner
Postfach 10 22 41
D-50462 Köln (DE)

Decision under appeal:

Decision of the Opposition Division of the
European Patent Office posted 2 November 1999
rejecting the opposition filed against European
patent No. 0582165 pursuant to Article 102(2)
EPC.

Composition of the Board:

Chairman: R. E. Teschemacher

Members: P. A. Gryczka

G. Santavicca

Summary of Facts and Submissions

I. The mention of the grant of European patent 0 582 165, in respect of European patent application No. 93111913.5, filed on 27 July 1993 and claiming the priority date of 28 July 1992 from US 920721, was published on 21 May 1997. The patent was granted on the basis of a set of 38 claims containing two independent claims which read as follows:

"1. A catalyst composition comprising a support having an active metal composition comprising from 2 % to 8 % by weight of copper as chloride or in the form of other copper salts, from 0.2 % to 2 % by weight of alkali metal(s), from 0.1 % to 9 % by weight of rare earth metal(s), and from 0.05 % by weight to 4 % by weight of metal(s) of Group IIA of the Periodic Table of Elements (IUPAC 1970), all weight percents based upon the total weight of the catalyst composition, wherein all the metals are deposited on the support, said catalyst composition having a surface area in the range of 20 to 220 m²/g."

"18. A process of oxychlorination of ethylene to produce 1,2-dichloroethane by contacting a mixture of ethylene, oxygen or oxygen containing gas and hydrogen chloride with a catalyst composition in a reaction zone and recovering 1,2-dichloroethane from the effluents of the reaction zone, comprising the use of a catalyst composition comprising from 2 % to 8 % by weight of copper as chloride or in the form of other copper salts, 0.2 % to 2 % by weight of alkali metal(s), from 0.1 % to 9 % by weight of rare earth metal(s), and from 0.05 % to 4 % of metal(s) of Group IIA of the Periodic

Table of Elements (IUPAC 1970), all weight percents based upon the total weight of the catalyst composition, said catalyst composition having a surface area in the range of 20 to 220 m²/g."

- II. A notice of opposition was filed on 21 February 1998 in which revocation of the patent in its entirety was requested on the grounds of lack of novelty and inventive step (Article 100(a) EPC) and insufficiency of disclosure (Article 100(b) EPC).

The following documents were cited during the opposition proceedings:

D1: Ullmanns Encyklopädie der technischen Chemie,
4. Auflage, Band 9, 1975, pages 428 to 432 and 492,
Verlag Chemie, Weinheim/Bergstr.

D2: GB-A-932 130

D3: GB-A-971 996

D4: EP-A-278 922

D5: US-A-4 446 249

- III. In a decision issued in writing on 2 November 1999, the opposition division rejected the opposition.

In its decision the opposition division held that:

- (a) The description of the patent in suit clearly specified that gamma alumina having a surface area of 150 to 165 m²/g was used for the experiments, which after impregnation with the metals resulted in a surface area which was 10 to 30% lower.

The skilled person knew that the alkali and alkaline earth metals could not be present in an oxychlorination catalyst in metallic form, as they would immediately react with oxygen and hydrogen chloride present in the reaction atmosphere. Further, it was clear from the description that the catalyst was prepared from metal salts and that the claim defined the amount of the metals which were present as metal salts.

The opponent had not proven that the catalyst would not be operative over the whole claimed range.

Therefore, the invention was sufficiently disclosed in the patent in suit.

- (b) D1 represented a summary of several documents that had to be taken on their own. None of the references cited there disclosed the subject-matter of claims 1 and 18.

D3 disclosed that the alkali metal salt or hydroxide of the catalyst according to D2 could be partially or completely replaced by alkaline earth metal salts or hydroxides. However, D3 did not specify the amount of alkali metal which should be replaced. Furthermore, the alumina support of the catalyst of D3 was heated to a temperature in the range of 800 to 1100°C. According to D7, a temperature of 800 to 1000°C resulted in an alumina support having from about 147,3 to 69,7 m²/g whereas a temperature of about 1060°C or

higher resulted in a surface not falling within the surface range defined in claim 1 of the opposed patent. This was confirmed by comparative example A in D5. Consequently, D3 did not disclose all the features of the claimed catalysts.

Even if one accepted that the wording of claim 1 of D5 encompassed the catalysts with four metals, the disclosed catalysts contained a maximum of three metals. According to the description of D5, the combinations of three metals were preferred. Therefore, D5 did not unambiguously disclose the claimed catalysts.

The other documents were less relevant.

Consequently, the claimed subject-matter was novel.

- (c) Any of D3 or D5 could be considered as representing the closest prior art. The technical problem underlying the patent in suit was the provision of a catalyst having better properties, in particular better balanced properties for a good performance, namely high productivity, conversion, selectivity and efficiency as well as good operability.

It was credible from the examples in the patent in suit and from additional experimental results that the technical problem had been effectively solved by the claimed catalysts.

D1 dealt with different technical aspects of the oxychlorination process derived from several

individual references which could not be combined. The problem of volatility of the catalyst resulting in its deactivation, as mentioned in D1, was not an issue in the patent in suit where the oxychlorination reaction was carried out at a temperature at which the volatility of copper chloride was small. D1 could be combined with D3 only retrospectively, i.e. by having knowledge of the claimed invention.

D3 did neither hint at a four metal catalyst nor at the advantages thereof. The only example of D3 did not comprise any alkali metal salt and the surface of the alumina was lower than that of the claimed catalyst.

The preferred catalysts according to D5 comprised only three metals and there was no suggestion that improvements could be achieved with a four metal catalyst.

The Proprietor had shown a synergy linked to the use of four metals in the catalyst. This could not have been expected from the teaching of D3 and D5.

D4 did not hint at incorporating rare earth (RE) metal salts into oxychlorination catalysts.

Therefore, the claimed catalysts and the process in which they were used involved an inventive step.

IV. On 28 December 1999 the Opponent (Appellant) filed a notice of appeal against the above decision and paid the corresponding fee on the same day. With the

statement setting out the grounds of appeal, filed on 2 March 2000, the Appellant submitted the results of comparative tests.

With a letter dated 10 November 2000, in reply to the grounds for appeal, the Proprietor (Respondent) filed results of further comparative experiments.

V. In a communication dated 5 October 2004 annexed to the summons to attend oral proceedings, the Board informed the parties on the issues to be discussed.

VI. With a letter received on 7 December 2004 the Appellant filed the document

D6: US-A-4 740 642

cited in the patent in suit and submitted that it was highly relevant for the issues of novelty and inventive step.

In reply, the Respondent filed with the letter dated 13 December 2004 six sets of amended claims as auxiliary requests 1 to 6 and requested that the oral proceedings to be held on 16 December 2004 be cancelled and that the proceedings be continued in writing.

VII. With a communication dated 13 December 2004 the Board informed the parties that the oral proceedings would be held as fixed.

VIII. Oral proceedings took place on 16 December 2004.

IX. The Appellant's arguments can be summarised as follows:

- (a) The objection of insufficiency of disclosure under Articles 100(b) and 83 EPC was not maintained.
- (b) D1 disclosed catalysts comprising four metals in the amounts as set out in claim 1 of the opposed patent. The characteristics mentioned there were common to most if not all oxychlorination catalysts. D1 was not just a summary of several documents. In any case, it was standing practice that the disclosure of a secondary document mentioned in the primary document had to be considered under the aspect of novelty. Therefore, the claimed catalyst lacked novelty over D1.

The whole content of D3 had to be considered in connection with D2, which was specifically cited in D3. The preferred components of the catalysts of D3 were 0.5 to 5% of Cu, 0,2 to 10% of rare earth metal ions and 0,2 to 10% of alkaline earth metal ions. D3 mentioned that the 0,5 to 5% alkali metal salts of the catalysts of D2 might be partially replaced by alkaline earth metal salts. That statement lead by necessity to catalysts containing mixtures of alkali and alkaline earth metal salts wherein the alkaline earth metal varied from amounts of higher than 0 to less than 10% and the alkali metal was within a fraction of the range 0,2 to 5% provided that the sum of the two metals was between 0,6 and 5%. As shown by the Appellant's tests, the heating of activated alumina at 800°C resulted in a surface of 156 m²/g. Taking into account that the patent in suit

indicated that the supported catalyst had a surface area of 10 to 30% lower than that of the alumina support, the surface area of the catalysts of D3 was within the range specified in claim 1 of the opposed patent. Therefore, the claimed catalyst lacked novelty over D3.

The claimed catalysts also lacked novelty in view of D5 which encompassed catalysts with four metals in amounts falling within the ranges defined in claim 1 of the patent in suit.

For the same reasons, the process according to claim 18 also lacked novelty.

- (c) Example 4 of D5 was the closest prior art. The only missing feature when compared to the catalysts of the patent in suit, was the presence of the rare earth (RE) metal component. The problem linked to the absence of this component was the volatility of copper chloride which deteriorated the catalyst performance. The problem to be solved by the claimed catalysts was thus to reduce the volatility of copper chloride and thus provide catalysts with better performance and longer durability.

The comparative experiments of the Respondent were not correctly evaluated by the opposition division as they showed in fact that the three metal catalysts provided the same or even a better ethylene efficiency than the four metal catalysts at 220°C and 225°C. At higher temperature, the efficiency was a little bit better, but this was a

process feature which was irrelevant to characterise the catalyst *per se*.

The comparative experiments filed with the Appellant's letter dated 2 March 2000 showed that a four metal catalyst (Cu, K, Mg and Ce) did not offer any advantage over a two metal catalyst (Cu and Mg).

Since D3 taught that the addition of RE metals reduced the volatility of the copper component, the solution provided by the patent in suit, namely the addition of an RE metal, was obvious.

Therefore, the claimed catalyst and process did not involve an inventive step.

- (d) US-A-740 742 (D6) was cited in the patent in suit as a reference most closely aligned with the claimed catalyst and process. Examples IV and VI of the patent in suit were carried out for comparative purposes on the basis of a catalyst disclosed in D6. Since D6 mentioned that 1% of alkaline earth metals such as Ba or Mg could be present in the catalysts, which amounted to the disclosure of a four metal catalyst, this document was more relevant to novelty and to inventive step than the other documents on file. Thus, D6 should be admitted into the proceedings.
- (e) D6 had been known to the Respondent who had acknowledged it in the originally filed application for the patent in suit. Thus, if the case was remitted in view of the admission of D6

into the proceedings, no apportionment of costs in favour of the Respondent should be awarded.

X. The Respondent's arguments can be summarised as follows:

- (a) D1 represented a general and unspecific overview of oxychlorination catalysts and failed to individualize the catalyst composition comprising the claimed group of four metals.

The combination of D2 with D3 yielded in a multiplicity of compositions in which the alkali metal might be partly or completely replaced by alkaline earth metal, however without individualization of a four metal catalyst. Furthermore, D2 and D3 did not contain any direct and unambiguous disclosure of the amounts of alkaline and alkaline earth metals and of the surface of the catalyst.

The same held true for D5 which disclosed only three metal catalysts.

The claimed subject-matter was therefore novel.

- (b) For the assessment of inventive step, example 4 of D5 could be considered as representing the closest prior art.

In relation to the catalysts disclosed in D5, the objective technical problem solved by the invention could be defined as the provision of a catalyst composition allowing an increased reactor productivity, in terms of a higher characteristic

operating temperature, while simultaneously providing high levels of feed stock conversion, reaction selectivity and product purity, as defined in the patent in suit.

That this problem was solved by the four metal catalysts in accordance with the patent in suit, compared to the three metals catalysts was apparent from the examples in the patent in suit.

The real benefit of the claimed four metal catalysts was the possibility of running the oxychlorination process at a higher temperature. As the productivity raised in the range from 2 to 3% per °C, an increased production capacity could be achieved at higher temperatures. As shown in the patent in suit, the four metal catalysts were superior to the three metal catalysts of D5 if tested under the same conditions at 230°C. It might be true that the claimed catalysts did not optimally operate at a temperature of 220 to 225°C, but instead they operated in a superior manner at 230°C.

There was no reason that would have motivated the skilled person to add a RE metal to the catalysts of D5. Copper volatility was a problem at a reaction temperature above 300°C as used in the process described in D2 or D3, but it was not an issue in the process according to the patent in suit as it was run at a lower temperature and in a fluidized bed where the catalysts was constantly replaced.

The Appellant's comparative experiments involving two metal catalysts were not carried out with the closest prior art and could therefore not be taken into account for the assessment of inventive activity. The tests of the Respondent filed with the letter dated 10 November 2000 showed that the performance of the four metal catalysts of the patent in suit was better when compared to two metal catalysts having the same surface area.

Thus, the claimed subject-matter involved an inventive step.

- (c) D6 and the argumentation in relation to it were submitted by the Appellant seven years after the expiry of the time limit for filing an opposition and one week prior to the oral proceedings in front of the Board. This conduct of the Appellant was unfair and represented a severe procedural abuse as it left no possibility for the Respondent to present its full scope of comments and evidence with regard to this document.

D6 was not more relevant than the other documents on file. The claimed subject-matter was novel over the disclosure of D6, as this document did not provide a direct and unambiguous disclosure of a four metal catalyst. With regard to inventive step D6 was not closer to the claimed catalysts than D5. Therefore, D6 should not be admitted into the proceedings.

- (d) If the case was remitted to the department of first instance as a consequence of the admission

into the proceedings of D6, the oral proceedings in front of the Board would be superfluous as they would not result in a final decision. Therefore, the costs involved by holding these oral proceedings and the future costs arising from a remittal should be apportioned in favour of the Respondent.

XI. The Appellant requested that the decision under appeal be set aside and that the patent be revoked. The Appellant agreed with the Respondent's request for remittal of the case to the first instance department if D6 was admitted into the proceedings, with the proviso that he would not be charged any costs of the Respondent.

XII. The Respondent requested that the appeal be dismissed and that the patent be maintained as granted.

In respect of the late filing of D6 he requested:

- (a) that D6 be not admitted into the proceedings;
- (b) in the alternative, if the Board considered D6 as sufficiently relevant for it to be admitted into the proceedings, the remittal of the case to the first instance department and an apportionment of costs in accordance with Article 104 EPC arising from the remittal;
- (c) as an alternative to the main request, that the patent be maintained on the basis of one of the six auxiliary requests filed with its letter dated 13 December 2004.

Reasons for the Decision

1. The appeal is admissible.
2. In view of late filed document D6, it is appropriate to firstly examine whether the patent can be maintained on the basis of the documents D1 to D5 on which the decision under appeal was based, and only then examine whether D6 should be admitted into the proceedings.

Main request (patent as granted)

Sufficiency of disclosure

3. Sufficiency of disclosure was no longer objected to by the Appellant. The Board sees no reason to examine this issue of its own motion.

Novelty

4. The patent in suit relates to a process of oxychlorination of ethylene to produce 1,2-dichloroethane and to a catalyst composition for the process. Independent claim 1 (catalyst composition *per se*) as well as independent claim 18 (process) require a catalyst composition comprising four metal components namely:
 - (i) from 2% to 8% by weight of copper as chloride or in the form of other copper salts,

- (ii) from 0.2% to 2% by weight of alkali metal(s),
- (iii) from 0.1% to 9% by weight of rare earth metal(s),
and
- (iv) from 0.05% by weight to 4% by weight of metal(s)
of Group IIA of the Periodic Table of Elements
(IUPAC 1970),

all weight percents based upon the total weight of the catalyst composition.

The metals of the group IIA are magnesium, calcium, strontium and barium (patent-in suit page 4, line 49), which are also named as "alkaline earth metals".

4.1 D1 is a document describing the general knowledge in the art of oxychlorination of ethylene, in particular the catalysts known for that reaction. It mentions that copper chloride, which is generally used for that purpose, evaporates under the gas phase reaction conditions and that the patent literature in this technical area mostly relates to additional activators which decrease the reaction temperature and thus the loss of copper. For that purpose, most of the catalysts contain the same amount of potassium chloride and copper chloride as well as partially further alkali and alkali earth metals (page 428, right handed column, last paragraph).

D1 further mentions that the addition from 1 to 10% by weight of rare earth metals (Ce, La) is also suggested in the patent literature for a better activity, selectivity and for a decrease of copper chloride

volatility. In this respect D1, *inter alia*, makes reference to the documents D2 and D3 (page 429, left handed column, first paragraph).

Since D1 does not mention that a rare earth metal is added to a catalyst already containing copper chloride, an alkali metal and alkaline earth metal, it does not unambiguously disclose the combination of the four metal components as required by the patent in suit. Furthermore, D1 does not disclose either the amount of each metal as required by the claims of the patent in suit.

Therefore, D1 cannot prejudice the novelty of the claimed catalyst and process.

The Appellant also combined the disclosure of D1 with the disclosure of D2 and D3 as these documents are mentioned in D1. However, D1 does not indicate explicitly or implicitly whether and how the disclosures of the different references should be combined. In fact, D1 only mentions D2 and D3 as references on which the general discussion concerning the evolution of the oxychlorination catalysts is based. Therefore, in order to determine which catalysts effectively belong to the state of the art, D2 and D3 have to be considered on their own.

D2 discloses a process for the production of chlorinated hydrocarbons which comprises contacting a feed containing an olefin, hydrogen chloride and molecular oxygen in the vapour phase at elevated temperature with a catalyst comprising copper deposited on activated alumina, the latter having been heated

prior to deposition of the copper to a temperature between 800 and 1400°C for not less than 2 hours (claim 1). In addition, the catalyst may contain at least one alkali metal hydroxide or salt as a promoter (claim 10), and also a hydroxide, salt or salts of at least one of the metals iron and the rare earth metals (claim 17). Examples 10 and 11 of D2 disclose a catalyst containing 2% of copper, 0.5% of potassium and 2% of lanthanum metals. Thus, D2 discloses catalysts containing three of the four metal components required by claims 1 and 18 of the patent in suit. However, D2 does not disclose that said catalysts further contain an alkaline earth metal, i.e. a metal of Group IIA.

Therefore, the subject-matter claimed in the patent in suit is novel with regard to D2.

- 4.2 D3 describes an improvement or a modification of the catalysts disclosed in D2 (page 1, lines 9 to 14) and indicates in this respect that the alkali metal salts of the catalysts according to D2 may be partially or completely replaced by alkaline earth metal salts or hydroxides, in particular magnesium salts or magnesium hydroxides (page 1, lines 32 to 36).

On the basis of this indication in D3, the Appellant came to the conclusion that D3 disclosed catalysts containing the four metal components required by the patent in suit.

- 4.2.1 D3 mentions that the alkali metal can be partially or completely replaced by alkaline earth metal components. A complete replacement would lead to a catalyst without alkali metal which is not encompassed by the patent in

suit. In case of a partial replacement, D3 does not mention to what extent the alkali metal should be replaced by an alkaline earth metal. Consequently, the respective amounts of the alkaline metal and of the alkaline earth metal as defined in the claims of the patent in suit are not directly and unambiguously disclosed by this passage of D3.

For these reasons the general teaching of D3 in relation with the modification of the catalysts of D2 does not unambiguously lead to catalysts according to the patent in suit.

- 4.2.2 The above conclusion is confirmed by the detailed description of D3 which mentions that the catalysts comprise copper deposited on activated alumina, the latter having been heated prior to deposition of the copper to a temperature from 800°C to 1400°C for at least 2 hours as claimed in D2, and are characterised in that they also contain an alkaline earth metal salt or hydroxide (page 1, lines 37 to 50; claim 1); the catalysts may also contain at least one salt of iron or a rare earth metal (page 2, lines 24 to 31; claim 7). The sole example in D3 discloses a catalyst containing copper, cerium and magnesium (page 2, example). D3 refers to the results obtained by use of alkaline earth metals "in place" of alkaline metal salts (page 2, lines 84 to 87). However, D3 does not disclose the possibility of further adding an alkali metal, nor does it disclose any catalyst containing an alkali metal. It follows that D3 does not mention any amount of alkali metal as defined in the claims of the patent in suit.

Therefore, D3 cannot prejudice the novelty of the catalysts and process in accordance with the patent in suit.

Consequently, it can be left open whether D3 discloses an alumina support having the surface area required by the claims of the opposed patent, which was contested by the Respondent.

- 4.3 D5 discloses catalyst compositions for the fluid-bed oxychlorination of ethylene consisting essentially of 2% to 12% by weight of copper as cupric chloride, on a fluidizable gamma alumina support having a surface area of about 60 to about 200 m²/g, wherein said support is modified prior to the deposit of copper by incorporating in it from 0.5% to 3.0% by weight based on the weight of the support of at least one added metal selected from the group consisting of potassium, lithium, rubidium, cesium, alkaline earth metals, rare earth metals and combinations thereof, by admixing a water soluble salt of the metal(s) with the gamma alumina support, drying the mix, and calcining the mix at 350 to 600°C for about 4 to about 16 hours and before the copper is deposited (claim 1).

The metal-modified gamma alumina support is prepared by first wetting a gamma alumina support with an aqueous solution of a salt(s) of the required metal or metals. The wetted alumina is then dried and calcinated whereby the added metal salt is converted to a metal oxide. The metal used in the aqueous solution can be in the form of any desired water soluble salt, such as a chloride or carbonate of (i) potassium, lithium, rubidium or cesium, preferably potassium or lithium; or (ii) of an

alkaline earth metal such as calcium, strontium or barium, preferably barium; or (iii) of a rare earth metal, such as lanthanum or cerium, or a mixture of rare earth metals such as the mixture didymium which contains lanthanum and neodymium together with smaller amounts of praeosodymium and samarium and even smaller amounts of other rare earth metals; or (iv) a mixture of salts of the metals recited, whether or not of the same class. The copper salt is then deposited on the modified alumina support (column 3, line 54 to column 4, line 20).

4.3.1 With regard to more specific combinations, D5 mentions that the mixtures of potassium with barium, cesium, or lanthanum, or the mixture of barium with lanthanum are particularly desirable for treating the support before impregnated with the copper compound (column 4, lines 10 to 12). This is also reflected in the claims of D5 which disclose the treatment of the support with potassium and barium (claim 9), potassium and lanthanum (claim 10), potassium and cesium (claim 11) or with barium and lanthanum (claim 12). Furthermore, it is not disputed that none of the examples of D5 was carried with a catalyst containing copper in combination with an alkali metal, an alkaline earth metal and a rare earth metal.

Thus, the specific combination of metals required by the claims of the patent in suit is not singled out in D5. In this situation, it is clear that the amounts of each component as defined in the claims of the patent in suit cannot be disclosed in D5.

- 4.3.2 For these reasons, D5 does not unambiguously disclose the catalysts in accordance with the patent in suit.
- 4.4 D4 was not cited by the Appellant in relation to the novelty objections. Since this document does not disclose catalysts containing rare earth metals, it cannot prejudice the novelty of the claimed subject-matter.
- 4.5 Consequently, the subject-matter according to the claims of the patent in suit is novel having regard to any of the documents D1 to D5.

Inventive step

Closest prior art

5. The patent in suit relates to a catalyst composition and a process for the oxychlorination of ethylene to 1,2-dichloroethane (EDC). The parties considered that D5, more particularly its example 4, represented the closest prior art. The Board sees no reason to take a different position.
- 5.1 D5 relates to the oxyhydrochlorination of ethylene to produce EDC. It discloses that the incorporation of certain specified metals into a gamma alumina support prior to and independently of depositing copper on the support, results in an improved gamma alumina copper catalyst which, when used as the fluid bed catalyst, improves significantly the EDC efficiency and the fluidization properties. The metal incorporated in the catalyst may be potassium, lithium, rubidium, cesium, an alkaline earth metal, a rare earth metal, or a

mixture of one or more such metals (column 2, lines 42 to 54).

Example 4 discloses an oxyhydrochlorination process carried out in presence of a catalyst prepared by impregnating gamma alumina with a mixture of 1% KCl and 1% BaCl₂, dried and then calcined for 8 to 10 hours at 400°C, after which the modified alumina is impregnated with 10% cupric chloride, dried slowly and heated 8 to 10 hours at 275°C (example 4 in connection with example 1, method (I)). According to the Respondent, this catalyst contains 4,9% copper, 0.5% potassium and 0,6% barium, expressed as % by weight of metal. Thus, the copper, alkali metal (potassium) and alkali earth metal (barium) contents of that catalyst fall within the ranges defined in claim 1 of the patent in suit, when the amounts of metal salts given in the example are converted in amounts of metals. This was not contested by the Appellant.

Technical problem and solution

5.2 Having regard to this prior art, the technical problem to be solved by the subject-matter of the patent in suit is to provide a catalyst composition allowing an increased reactor productivity, in terms of a higher characteristic operating temperature, while simultaneously providing high levels of feed stock conversion, reaction selectivity and product purity (patent in suit, page 2, line 56 to page 3, line 3; page 3, lines 16 to 21).

The Appellant argued that the sole problem which could be defined with regard to D5 was to reduce the

volatility of the copper chloride in the catalyst compositions disclosed therein. An improvement in this respect would inherently provide a catalyst with better performances and durability. However, neither D5, nor the patent in suit make reference to this technical problem. It is not contested that the volatility of copper chloride in oxychlorination catalyst is a well known problem. For example D1 mentions it and indicates that it could be solved by the addition of alkali or alkali earth metals to the copper chloride containing catalysts (page 428, right handed column, last paragraph). Such additional metals are already present in the catalysts of D5. Hence, in the absence of any proof to the contrary, the problem of volatility of copper was not a concern for the catalysts of D5.

- 5.3 A catalyst in accordance with D5 is mentioned for comparative purposes in the patent in suit; according to the Respondent, this catalyst essentially corresponds to the catalyst of example 4 of D5 (example III, page 7; page 3, lines 46 to 53; figures 1 to 3). Figures 1 to 3, in connection with example III (three metal catalyst essentially corresponding to example 4 of D5), example V (four metal catalyst according to the patent in suit) and example VII (four metal catalyst according to the patent in suit), show that a "four metal catalyst" according to the patent in suit provides better EDC selectivity and HCl conversions, as well as lower by-product selectivity (triane) resulting in a higher EDC purity, than the catalyst of D5. These results show the improvement over the closest prior art catalyst mentioned in more general terms in the patent in suit (page 6, line 1 to 14).

The Appellant argued that the claimed catalyst did not provide an improvement at reaction temperatures under 230°C. However, irrespective of whether it is required that a catalyst shows improved effects over each possible operating temperature, the skilled person would look for any improvement in a temperature area at which it makes sense to carry out the reaction. In the present case, the Respondent argued that the oxychlorination reaction carried out at higher reaction temperatures resulted in higher productivity. Hence, the improvement observed at high reaction temperatures is in the present case beneficial.

The parties have presented controversial results when comparing a two metal catalyst with a four metal catalyst in accordance with the patent in suit. According to the Appellant's tests, a two metal catalyst performed better than a four metal catalyst (test report annexed to the Appellant's letter dated 2 March 2000). The Respondent mentioned that the different results observed by the Appellant were linked to the fact that the compared catalysts did not have the same surface area. If the surface area was the same, a four metal catalyst would show better performance than a two metal catalyst (Respondent's letter dated 10 November 2000, point 2.3.10). The Board is of the opinion that an adequate comparison should involve catalysts with the same surface area, as this feature might influence the performance of the catalysts. In addition, the three metal catalysts in accordance with D5 are in respect of their structure more closely related to those of the patent in suit than the two metal catalysts with which these comparisons were

carried out. This was not disputed by the parties who had the same opinion on the choice of the closest prior art (point 5). Therefore, the results observed when comparing a three metal catalyst of D5 with the claimed catalyst are more relevant for assessing whether the technical problem underlying the patent in suit has been solved than the controversial results observed with two metal catalysts.

- 5.4 Consequently, it can be concluded that the technical problem as defined herein above (point 5.2) has effectively been solved by the catalysts according to claim 1 and the process of oxychlorination involving such catalysts according to claim 18 of the patent in suit.

Obviousness

- 5.5 It remains to be decided whether any of the documents D1 to D5 made the claimed subject-matter obvious.

5.5.1 In this respect, the question arises whether it was obvious to the skilled person to add a fourth metal, namely a rare earth metal to the catalyst of example 4 of D5, in order to solve the technical problem defined above.

5.5.2 D5 concerns the improvement of the EDC efficiency and fluidization properties of oxychlorination catalysts and suggests for that purpose to incorporate certain metals into a gamma alumina support before the deposition of copper (column 2, lines 42 to 54). The preferred catalysts obtained after treatment of the support are based on a combination of three metals

namely copper, barium and potassium, or copper, potassium and lanthanum, or copper, potassium and cesium, or copper, barium and lanthanum (column 4, lines 10 to 12, claims 9 to 12, examples 4 and 5). As the "three metal" catalysts are unambiguously preferred, the skilled person cannot derive from D5 that a catalyst containing the combination of four metals as defined in claim 1 of the patent in suit, would allow an increased reactor productivity, in terms of a higher characteristic operating temperature, while simultaneously providing high levels of feed stock conversion, reaction selectivity and product purity.

Thus, D5 does not suggest that the technical problem as defined above could be solved by the claimed "four metal" catalysts.

- 5.5.3 According to D1, copper chloride generally used as the catalytically active component in oxychlorination catalysts presents an important disadvantage as it is volatile under the reaction conditions. D1 provides an overview of the solutions proposed to that problem by various patent documents. In this context, D1 mentions the addition of potassium chloride, and of other alkali metals or alkaline earth metals to copper chloride containing catalysts (page 428, right handed column, last paragraph). Furthermore, according to D1 the addition of rare earth metals, namely La and Ce, was known to increase the activity and selectivity and decrease the volatility of copper chloride. In this respect, D1 *inter alia* makes reference to documents D2 and D3. However, D1 does not mention that rare earth metals should be added to catalysts already containing alkali metals and alkali earth metals.

Therefore, D1 gives no hint to the "four metal" catalyst in accordance with the patent in suit.

- 5.5.4 According to D2, the use of a heat treated alumina as catalyst support reduces the amount of carbon dioxide present in the reaction products of the oxyhydrochlorination of olefins and substantially increases the yield of the desired chlorinated hydrocarbon (page 1, lines 22 to 38). Thus, D2 primarily suggests a heat treatment of the support to improve the reaction yields. With regard to the metal components, D2 proposes the addition of an alkali metal hydroxide or salt as promoter (page 1, lines 73 to 77) and the further addition of hydroxides or salts of iron or rare earth metals to reduce the volatility of copper (page 2, lines 9 to 15). However, D2 makes no reference to alkaline earth metal components and gives no hint to any possible improvement in terms of yield and selectivity linked to a particular choice of metal components.

Thus, the specific combination of four metals as defined in the claims of the patent in suit cannot be derived from that document alone or in combination with the teaching of D5.

- 5.5.5 According to D3, the catalysts of D2 may be improved by partially or completely replacing the alkali metal by an alkaline earth metal (page 1, lines 9 to 36). D3 does however not disclose any catalyst containing the four metals required by the claims of the patent in suit (point 4.3.2). In addition, the effect which should be reached by the introduction of a rare earth

metal is not indicated in D3. With regard to an improvement in yields and selectivity, the teaching of D3 does not go beyond that of D2 which only puts emphasis on a specific heat treatment of the alumina support (point 5.5.4).

That selectivity and yield could be improved by selecting the specific metal components could therefore not be derived obviously from D3 alone or in combination with D2 and/or D5.

5.5.6 According to D4, the behaviour of fluidized catalyst containing cupric chloride, and the conversion and selectivity values exhibited in the oxychlorination of ethylene, can be improved when the catalysts also contain measured quantities of at least one alkali or alkaline-earth metal chloride, uniformly distributed over the entire surface area of the particles (page 2, lines 22 to 26). The catalysts disclosed in D4 contain a mixture of copper and calcium (example 1), copper, calcium and magnesium (example 2) or copper, calcium and lithium (examples 3 and 8). D4 is however silent with respect to the addition of a rare earth metal as required by the catalysts of the patent in suit. The claimed "four metal" catalysts and the effects linked to their use in the oxychlorination of ethylene can thus not be derived from that document alone or in combination with D5.

5.5.7 It can therefore be concluded that the catalyst and the process according to the claims of the patent in suit involve an inventive step when considering the documents D1 to D5.

5.6 Consequently, the Board arrives at the same conclusions as the opposition division with regard to the patentability of the subject-matter claimed in the patent in suit when considering documents D1 to D5.

Late filed document D6

6. D6 relates to a catalyst for the oxychlorination of ethylene to EDC, consisting essentially of a fluidizable alumina support having a surface area of from about 80 to about 200 m²/g having deposited thereon from about 4% to about 17% by weight of a copper salt, about 0.25% to about 2.3% by weight of an alkali metal salt(s), and from about 0.2% to about 15% by weight of a rare earth metal salt(s), all weight percents based upon the total weight of the catalyst composition (claim 1).

D6 also mentions in column 6, lines 47 to 53, that: "Other metals can be present in the catalyst compositions of the invention in relatively small amounts. For example, alkaline earth metals and/or transition metals can be present in up to about 1% by weight total based on the total weight of the catalyst composition. Examples of such other metals are magnesium, barium, iron, and the like."

The document is also acknowledged in the patent in suit as one of the two references most closely aligned with the catalyst and process of the invention (page 3, lines 4 to 7). It appears therefore that D6 is more relevant than documents D1 to D5 on which the first instance has taken its decision.

Therefore, in conformity with the well established practice of the Boards of Appeal when exercising their discretion under Article 114(2) EPC, D6 is admitted into the proceedings (Case Law of the Boards of Appeal of the EPO, *supra*, VI.F.3.1.1).

Remittal

7. As D6 was filed and cited against the patentability of the claimed subject-matter for the first time in the present appeal proceedings, it is appropriate to remit the case to the department of first instance in accordance with Article 111(1) EPC so that the document can be examined at two levels of jurisdiction. Remittal also gives the Respondent the possibility to adequately prepare his defence with regard to that document.

Apportionment of costs

8. D6 is cited in the patent in suit as a prior art closely related to the invention subject of the patent in suit (point 6). This document was already mentioned in the patent application as filed. The filing of that document by the Appellant at a very late stage of the appeal proceedings is consequently unjustified. In the absence of any good reason for this late filing, the Board considers that the Appellant failed to exercise appropriate care in preparing its case properly and submitting relevant documents as early as possible. By the late filing of D6, the Appellant has delayed the final outcome of the proceedings. As a consequence of the late filing of D6, the oral proceedings before the Board did not result in a final decision with regard to the patentability of the claimed subject-matter. In

these circumstances, the Board finds it appropriate for reasons of equity to order a different apportionment of costs under Article 104(1) EPC. It is consequently justified that the Appellant shall pay the Respondent the costs as defined in point 4 of the order.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. Document D6 is admitted into the proceedings.
3. The case is remitted to the department of first instance for further prosecution.
4. The costs shall be apportioned so that the Appellant shall pay the Respondent:
 - (a) the costs charged by the Respondent's European professional representative to the Respondent for the participation in the oral proceedings before the Board; and
 - (b) the expenses (travelling, accommodation) for the accompanying person at the oral proceedings before the Board.

The Registrar:

The Chairman:

C. Eickhoff

R. E. Teschemacher