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File Number: T 493/90 - 3.3.2

Application No.: 84 400 556.1

Publication No.: 0 119 933

Title of invention: Supported catalyst for the synthesis of 1,2-dichloro-ethane by oxychlorination of ethylene within a fluidized bed

Classification: B02J 23/72

**D E C I S I O N**  
of 10 December 1991

Applicant: AUSIMONT S.p.A.

Opponent: The B.F. Goodrich Company

Headword: Copper depleted catalyst/AUSIMONT

EPC Articles 54 and 56, Rule 88

Keyword: "Correction of a calculation error in the description (yes)" -  
"Corrected value and range in the amended claims (yes)" -  
"Inventive step (no)" - "Solution based on the same idea" -  
"Properties not attributable to the process features"

**Headnote**



Case Number : T 493/90 - 3.3.2

**D E C I S I O N**  
of the Technical Board of Appeal 3.3.2  
of 10 December 1991

**Appellant :**  
(Proprietor of the patent)

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**Decision under appeal :**

Decision of Opposition Division of the European  
Patent Office dated 24 April 1990 revoking  
European patent No. 0 119 933 pursuant to  
Article 102(1) EPC.

**Composition of the Board :**

**Chairman :** P.A.M. Lançon  
**Members :** M.M. Eberhard  
R.L.J. Schulte

Summary of Facts and Submissions

I. European patent No. 0 119 933 was granted with nine claims on the basis of European patent application No. 84 400 556.1. Independent Claim 1 reads as follows:

"A supported particulate catalyst for the synthesis of 1,2-dichloroethane (by means of C<sub>2</sub>H<sub>4</sub> oxychlorination within a fluidized bed) comprising a Cu compound in amounts corresponding to a Cu content from 1 to 10% by weight - as Cu metal - obtained by dry impregnation (with a solution of a Cu compound) of a carrier preferably selected from the group consisting of microspheroidal Al<sub>2</sub>O<sub>3</sub>, microspheroidal SiO<sub>2</sub> and microspheroidal silica-alumina, wherein the sum of the moles of Al and Si (and of any other possible metal contained in the carrier) is indicated hereinafter as  $\sum [Me]$  and wherein the moles of copper, present in the catalyst as a whole, are indicated hereinafter by [Cu], characterized by the fact that the molar ratio:

$$\frac{\text{outer Me}}{\text{outer Cu}}$$

(as determined by X-Ray Photoemission Spectroscopy using the K-alpha radiation of Mg and integrating the photoemission peaks, to give an intensity value which, after correction by a respective sensitivity factor, is directly proportioned to the surface atomic concentration of the respective elements) is at least 40% higher than the molar ratio:

$$y = \frac{\sum [Me]}{[Cu]} "$$

Independent Claims 5 and 6 related to a process for the preparation of this catalyst.

- II. The Respondent (Opponent) filed a notice of opposition requesting revocation of the patent on the grounds of lack of novelty and of inventive step. Of the documents cited in the notice of opposition and after expiry of the opposition period, only US-A-4 339 620, i.e. document (3), was relied upon during the oral proceedings before the Board.
- III. The Opposition Division revoked the patent. In the decision novelty of the claimed catalyst was acknowledged over document (3). It was further pointed out that the problem of providing excellent fluidisation properties had already been solved in document (3) by similar technical measures, i.e. by depleting the prefabricated catalyst of copper to a certain extent. As regards the dichloroethane yield and the HCl conversion, the Opposition Division came to the conclusion that the comparative examples of Table 2 of the patent did not support the Proprietor's contention that both the yield of dichloroethane and the HCl conversion were improved. Therefore, in the Opposition Division's opinion, the claimed catalyst did not solve the objective problem underlying the alleged invention and thus no inventive step was recognisable. The method claims were also regarded as lacking inventive step.
- IV. The Appellant (Patentee) lodged an appeal against this decision. About two weeks before oral proceedings, which were held on 10 December 1991, the Appellant presented a request for correction of obvious errors in Table 1 of the patent. During the oral proceedings he submitted an amended set of nine claims as main request and an amended Claim 1 as auxiliary request.

Claim 1 of the main request differs from the granted Claim 1 in that "at least 40%" has been replaced by "at least 79.37%" and commas have been substituted for the brackets. Claims 2 to 9 are identical to the granted Claims 2 to 9 except for the deletion of the brackets and the insertion of commas. In Claim 1 of the auxiliary request the catalyst is defined by the same combination of features as in Claim 1 of the main request plus its method of preparation according to either Claim 5 or Claim 6.

V. The main arguments put forward by the Appellant as regards the requirement of inventive step can be summarised as follows:

The "efficiency" mentioned in Table 1 of document (3) corresponds to the dichloroethane yield (DCE yield) defined in the patent in suit. This table shows that a DCE yield higher than 95.2% could not be obtained whatever the condition of temperature, HCl/C<sub>2</sub>H<sub>4</sub> ratio and contact time. Moreover, this yield was achieved with a HCl/C<sub>2</sub>H<sub>4</sub> feed ratio greater than 2, which leads to relatively low HCl conversions and increases the costs of neutralisation by caustic. The highest DCE yield obtained with a HCl/C<sub>2</sub>H<sub>4</sub> ratio < 2 is 94.9%, i.e. smaller than with the catalysts of the opposed patent.

Table 2 of the patent demonstrates that the fluidisation behaviour of the prior art catalyst A is negatively affected by increasing the HCl/C<sub>2</sub>H<sub>4</sub> ratio and becomes bad at a ratio of 1.936 whereas the fluidisation of the claimed catalyst remains excellent at this ratio and even at higher ratios, for example 1.945. With the claimed catalysts the synthesis of DCE can be carried at higher HCl/C<sub>2</sub>H<sub>4</sub> ratios with an excellent fluidisation behaviour while simultaneously obtaining higher DCE yields and high

HCl conversions as shown by examples 8, 12 and 15 of Table 2. Although oxychlorination has been carried out at 220°C with catalysts A and B and at 225°C with the catalyst of the invention, the additional examples in Table 2bis of the Statement of Grounds of Appeal establish that the changes of yields and conversions due to a difference of 5°C are negligible. Likewise the fact that the catalyst contains a Mg-salt contrary to the unpromoted catalysts A and B has no great influence upon its performance since the difference in yield is only 0.2-0.3 points. Nobody could imagine in view of the prior art that the claimed catalyst could allow the obtention of excellent results simultaneously for DCE yields, HCl conversion and fluidisation with HCl/C<sub>2</sub>H<sub>4</sub> ratios higher than those which could be obtained till now.

Document (3) comprises examples with HCl/C<sub>2</sub>H<sub>4</sub> ratios of 1.86 or higher (cf. Table 1), however even if as mentioned therein no stickiness is observed, this table does not show that an increase of the HCl/C<sub>2</sub>H<sub>4</sub> ratios results in higher DCE yields, nor does it mention the corresponding HCl conversions. Furthermore it can be inferred from Table C of the Statement of Grounds of Appeal that the addition of bare alumina to a copper chloride catalyst of the kind described in (3) has a negative influence on DCE yields and does not improve the fluidisation behaviour at all. The performance of the diluted catalyst as regards conversion and DCE yield are very low with respect to those of the claimed catalyst. Moreover according to (3) the distribution of CuCl<sub>2</sub> on the support is more uniform than usual, therefore there existed a prejudice against the reduction of the copper chloride concentration at the catalyst surface.

The Appellant contested the validity of the Respondent's data reported in Table B enclosed with his letter of

16 February 1990 because they were obtained at a pressure of 1 At.

VI. The Respondent contended that the correction of the errors at page 6 of the patent was not obvious in the sense defined in Rule 88. Thus 8 years have elapsed without this error being noticed by anybody. Furthermore it was not immediately evident whether the error lay in the values of K in the examples 3 to 6 or in the formula in the last column of the table. In the Respondent's opinion, even if this correction were considered as allowable, the corresponding amendment in Claim 1 would contravene Article 123(2) since only three values of K were disclosed in the description, not a range.

In his letter dated 26 February 1991 the Respondent submitted results of XPS-measurements made on catalysts according to examples 1, 2 and 3 of document (3). He contended during oral proceedings that the XPS-data obtained for the catalyst of example 1 clearly fell within the claimed range and therefore the catalyst as defined in Claim 1 of the main request was not novel.

In connection with inventive step the Respondent cited a.o. EP-A-0 058 644 (document (8)) and stressed that it was also known from (8) that catalyst stickiness was caused by high concentrations of copper salt on the outer surface of the support. He referred to the test data reported in Table B of his letter dated 16 February 1990 and argued that the reactor design had a great influence upon the DCE yield. He also contended that, as shown in Table B, the catalyst of (3) exhibited good fluidisation properties even at HCl/C<sub>2</sub>H<sub>4</sub> ratios > 2 and gave excellent DCE yields. The Respondent emphasised that the commercially feasible operating range was limited to

HCl/C<sub>2</sub>H<sub>4</sub> feed ratios below 1.98, higher ratios being not feasible due to poor HCl conversion and excessive caustic consumption. Performance curves of the catalysts according to examples 7 to 26 of the patent in suit were submitted as well as an economic comparison of the catalysts. In the Respondent's view these curves revealed that the claimed catalysts neither solve any technical problem nor provided any performance benefit over catalysts A and B in particular as regards DCE yields and HCl conversion.

- VII. The Appellant requested that Table 1 of the description of the patent be corrected according to the letter dated 27 November 1991, that the decision under appeal be set aside and that the patent be maintained on the basis of Claims 1 to 9 filed during oral proceedings (main request), or Claim 1 filed during oral proceedings as auxiliary request and Claims 2 to 9 of the main request. The Respondent requested that the appeal be dismissed.

#### Reasons for the Decision

1. The appeal is admissible.
2. The Appellant has requested that the erroneous values 44.25%, 44.25%, 50.44% and 57.92% in the last column of Table 1 (values of K in examples 3 to 6) be replaced by the correct values 79.37%, 79.37%, 101.79% and 137.67% respectively. In the following, the first table of page 6 of the patent is termed Table 1a and the second one Table 1b.

In order for correction under Rule 88 to be allowable, it must be established (i) that an error is present in the document as filed at the EPO and (ii) that the correction is obvious in the sense set out in Rule 88, i.e. "in the



sense that it is immediately evident that nothing else would have been intended than what is offered as the correction".

The values of K are derived from calculations based upon the formula  $K = 100(X-Y)/Y$  as indicated in the last column of Table 1a. With regard to examples 1 and 2 the values of K mentioned in the last column are in agreement with the values of X and Y stated in the third and fourth columns of Table 1a when the calculation is based on this formula. However, this is not the case for examples 3 to 6. Therefore by solely checking this simple calculation the skilled reader would recognise that an error has occurred in Table 1a. Having noticed this error he would try to find out whether this inconsistency is due to a calculation error or whether the values of X or of Y themselves are not correct. In the Respondent's opinion a third possible cause for this inconsistency could be that the formula itself is wrong and should read  $K = 100(X-Y)/X$  since the values of K given in Table 1a for examples 3 to 6 were obtained by dividing the difference  $100(X-Y)$  by X instead of Y.

As the values of X reported in Table 1a are identical to those given in Table 1b (last column) and in Table 2 (page 7, third column), the skilled reader would have no reason to believe that they are wrong. The value of 22.3 for Y is in agreement with the  $\text{CuCl}_2$  content and catalyst composition stated at page 5 (lines 49 to 59) of the patent and consequently it can also be regarded as correct. Moreover it is expressly indicated in Claim 1 and in the paragraph bridging pages 4 and 5 of the patent that the molar ratio "outer Me/outer Cu", namely X, is at least 40% higher than the molar ratio  $Y = \sum [\text{Me}]/[\text{Cu}]$ . As this statement is equivalent to  $(X-Y)/Y > 40\%$  it is immediately derivable therefore that the formula mentioned in Table 1a

is also correct. Consequently only one possibility remains as to the erroneous values in Table 1a, namely the values of K in examples 3 to 6. It is also immediately evident in the present case that nothing else would have been intended than what is offered as the correction since calculation of the values of K on the basis of the formula and values of X and Y indicated in Table 1a leads to 79.37% for examples 3 and 4, 101.79% for example 5 and 137.67% for example 6. For the preceding reasons the Board considers that the request for correction under Rule 88 is allowable and therefore the corrected version of the patent is taken as the basis for the decision of the Board.

Main Request

3. There are no objections under Article 123(2) and (3) to the amended claims. Claim 1 is based upon Claim 1 of the application as originally filed and upon features stated in the description thereof, namely at page 7, lines 18 to 19; page 9, lines 9 to 11; page 12, lines 7 to 22, and page 8, lines 19 to 22. The lower limit "at least 79.37%" is supported by the corrected value of K in Table 1. The Board cannot share the Respondent's opinion that only three values of K are disclosed in the original application since it is expressly mentioned at page 7 (lines 20 to 26) thereof that X may vary between 40:1 and 53:1. The corresponding range for K is directly derivable from Table 1 which indicates these upper and lower values as well as the value of Y. The dependent Claims 2 to 4 and the process Claims 5 to 9 are supported by the original Claims 2, 3 5 and 6 to 10. The activation step in air at 180 to 300°C is clearly disclosed in the original description, at page 8, lines 12, 13, 28 and 29. Therefore these claims are also in conformity with the requirements of Article 123(2).

In addition, the amended claims manifestly do not broaden the scope of the granted claims since the range for the molar ratio outer Me/outer Cu has been restricted.

4. The Board has come to the conclusion that of the new documents cited for the first time at the appeal stage only document (8) was relevant in view of its teaching about the cause of stickiness. Therefore, it has decided to introduce (8) into the proceedings pursuant to Article 114(1) EPC.
  
5. Concerning novelty the Board cannot follow the Respondent's opinion that document (3) already discloses a catalyst having a molar ratio outer Me/outer Cu, as determined by X-Ray Photoemission Spectroscopy (XPS), which is at least 79.37% higher than the mole ratio Y.

According to the Respondent, the XPS data reported in his letter of 26 February 1991 were measured on catalyst samples which were prepared as set forth in examples 1, 2 and 3 of document (3) and then handled under air or nitrogen before XPS analysis or exposed to oxychlorination conditions for 24 hours. The corresponding XPS data in Tables I, II and III demonstrate that the distribution of copper on the surface of the catalyst as defined by  $K = 100(X-Y)/Y$  depends upon the conditions under which the catalysts were handled before analysis. All the samples exhibit values for K which are smaller than the lower limit 79.37% stated in Claim 1 except for example 1 of Table II. However as admitted by the Respondent during oral proceedings, the diluted catalyst of this example was not subjected to a treatment under oxychlorination conditions like the diluted catalyst of (3), although according to (3), this treatment causes the transport of a portion of the  $CuCl_2$  from the surface of the supported

catalyst to the particles of the bare support (cf. column 3, lines 20 to 28). Instead of this treatment, nitrogen was passed through the mixture for a short time at room temperature. Under these circumstances and as (3) does not disclose any treatment of the catalyst with nitrogen, the Board must conclude that the catalyst of example 1 of Table II does not represent a catalyst according to the teaching of (3). The Respondent's argument that  $\text{CuCl}_2$  is hygroscopic and formation of the hydrate should be avoided does not prove that the prior art catalysts were handled under nitrogen since handling under dry air would also prevent this formation. Therefore the claimed catalyst is regarded as novel with respect to those of (3) in that the concentration of copper on the surface of the catalyst particles is reduced to a different extent.

6. It still remains to be examined whether the requirement of inventive step is met by the claimed subject-matter.

6.1 In agreement with the parties, the Board considers document (3) as the closest prior art. This document discloses a catalyst for the synthesis of 1,2-dichloroethane (DCE) by means of ethylene oxyhydrochlorination within a fluidised bed. This catalyst consists of cupric chloride supported on a fluidisable alumina support, the amount of  $\text{CuCl}_2$  corresponding to a copper content of 2 to 10 wt%. The catalyst was prepared by impregnation of the support with a solution of  $\text{CuCl}_2$  (cf. column 1, line 54 to column 2, line 20). According to (3) the catalyst particles have a tendency to agglomerate during operation of the oxyhydrochlorination process and this "stickiness" impairs the fluidisation characteristics of the bed. In order to decrease or inhibit stickiness bare fluidisable alumina support is added to the supported cupric chloride catalyst. As the oxyhydrochlorination proceeds, a portion

of the cupric chloride on the supported catalyst becomes released therefrom and is deposited in situ on the bare support so that stickiness of the  $\text{CuCl}_2$  containing catalyst particles in the fluid bed is alleviated (cf. column 3, line 52 to column 4, line 7, Abstract). In example II no stickiness was observed in a run of 85 hours carried out in a laboratory reactor of 300 mm diameter with a catalyst bed height of 38 cm, and the bed fluidised excellently throughout. The highest DCE yield with respect to ethylene (termed % Efficiency in Table I of (3)) is 95.2% with a  $\text{HCl}/\text{C}_2\text{H}_4$  feed ratio of 2.12. If  $\text{HCl}$  is not in excess over the stoichiometric requirement, i.e. with a  $\text{HCl}/\text{C}_2\text{H}_4$  ratio less than 2, the highest DEC yield obtained with the diluted catalyst of example II is 94.9%.

6.2 In the Board's view, the problem to be solved with respect to this prior art can be seen in providing a catalyst which in industrial exploitation exhibits excellent fluidisation properties and simultaneously leads to high DCE yields and high  $\text{HCl}$  conversions.

It is proposed to solve this problem by depleting the copper concentration at the surface of the catalyst with respect to the bulk copper concentration in the catalyst to the extent defined in the characterising part of Claim 1. In view of the fluidisation quality, the DCE yields and the  $\text{HCl}$  conversions achieved with the catalysts of examples 12, 15, 22 and 24 of the patent under conditions used in industrial exploitation, it appears to the Board that this problem has been plausibly solved by the claimed features.

6.3 During oral proceedings the Appellant has contended that the problem to be solved with respect to (3) was to provide a catalyst with improved fluidisation properties which enables to obtain higher DCE yields in industrial

exploitation while maintaining high HCl conversions. However the Respondent has submitted that no improvement was obtained with the claimed catalyst.

6.3.1 The Appellant's comparative tests illustrating the performance of the catalysts of (3) and of the disputed patent (cf. Tables C and D of the Statement of Grounds of Appeal and of the letter dated 5 September 1989) were contested by the Respondent, who, for his part, also performed tests with the catalysts of (3) (cf. Table B, examples 1 to 66 of the letter dated 16 February 1990). However, according to the Respondent's tests, the catalysts of (3) containing 5% copper would exhibit excellent fluidisation properties before dilution with the bare alumina whatever the reactor design. This is not consistent with the stickiness rating of 3.5 or 3.75 given in example II of document (3) (a patent assigned to the Respondent). On the other hand, the Appellant's Tables C and D show that addition of the bare alumina to the supported cupric chloride catalyst would not improve fluidisation at all contrary to the teaching of (3) and would lead to DCE yield which are very low in comparison with those stated in Table I for a contact time of about 20 seconds. In view of these discrepancies, the Board doubts that the prior art catalyst has been prepared following the teaching of (3) and, thus, it is not convinced that the alleged improvements have been really achieved.

6.3.2 A direct comparison of the DCE yields indicated in Table 2 of the disputed patent (examples 11 to 16 and 20 to 26) with the data disclosed in Table I of (3) is also meaningless since the catalysts have been tested in reactors of different dimensions and design and under different conditions of pressure and contact time. As shown by the Respondent and not contested by the

Appellant, DCE yields can be significantly affected by the reactor design at least at a pressure of 1 At. Furthermore the data of Table I concern a diluted catalyst containing only 2.5% copper and no promoter whereas the data of the opposed patent relate to promoted catalysts having a copper content of 5 wt%. Consequently, although the direct comparison shows an improvement of the DCE yield with respect to the diluted catalysts of (3), it cannot be deduced therefrom whether this improvement is attributable to the claimed solution, i.e. to the depletion of particle surface copper concentration to the claimed extent, or to the difference in the other parameters.

6.3.3 To support their opposite allegations, the parties have also referred to the comparative examples of the disputed patent, in which the performance of the claimed catalyst are compared with those of "prior art" catalysts A and B having no copper depletion on their surface (cf. Table 2 of the patent). As the HCl conversion drops much below 99% with HCl/C<sub>2</sub>H<sub>4</sub> feed ratios higher than the stoichiometric requirements, only the results obtained with HCl/C<sub>2</sub>H<sub>4</sub> ratios less than 2 are taken into consideration. From Table 2 it appears clearly that the fluidisation properties of the claimed catalysts remain excellent when the HCl/C<sub>2</sub>H<sub>4</sub> ratio is raised up to values of 1.936 or 1.945 whereas the fluidisation behaviour of the prior art catalyst A is already bad at a HCl/C<sub>2</sub>H<sub>4</sub> ratio of 1.936. A comparison of example 8 with examples 12 and 15 shows that the improvement of fluidisation quality is accompanied with an increase in the DCE yields (based on crude or on pure DCE) of about 0.9 or 1.2 points with respect to catalyst A. However, the corresponding HCl conversion is decreased by about 0.3 or 0.4 points although it remains over 99%. The tests of these examples were indeed performed at different temperatures and the catalysts according to the disputed patent contains a Mg salt

whereas catalyst A is unpromoted. However, as indicated by the Appellant, the DCE yield is only about 0.2 to 0.3 points higher in the presence of  $MgCl_2$  and the HCl conversion is similar. Moreover operation at  $220^\circ C$  instead of  $225^\circ C$  seems not to decrease the DCE yield of the claimed catalyst (cf. Table 2bis of the Statement of Grounds).

It results from the preceding that in industrial exploitation a catalyst having its surface copper concentration reduced to the claimed extent has an improved fluidisation behaviour and gives slightly higher DCE yields than a catalyst without any copper depletion at the surface while the HCl conversion remains high. However, in the Board's opinion it cannot be derived therefrom that improvements would also be achieved with respect to a catalyst containing particles whose surface is already depleted of  $CuCl_2$  to a certain extent like the diluted catalyst of (3), i.e. with respect to the catalyst of the closest prior art. Accordingly, in the absence of evidence convincingly showing that the claimed catalysts lead to improved fluidisation characteristics and DCE yields with respect to the diluted catalysts of (3), the Board cannot consider that the problem defined by the Appellant has been credibly solved. Therefore the technical problem formulated in point 6.2 above (which has been effectively solved) is taken into consideration for the assessment of inventive step.

- 6.4 As already indicated above, document (3) is concerned with the problem of decreasing the catalyst stickiness which impairs the fluidisation characteristics of the bed. It teaches that the degree of stickiness is dependent on operating conditions such as pressure, temperature of the reaction, quantity and ratios of the gaseous reactants in the fluid bed and also on the catalyst characteristics



such as porosity, amount and distribution of the copper on the particle surfaces, ratio of the weight of copper to the surface area of the support (cf. column 2, lines 24 to 45). Furthermore, according to document (8), the catalyst stickiness is caused by high concentrations of the copper salt on the outer surface of the support (cf. page 5, lines 15 to 25; examples 4, 7 and 8). The problem of stickiness is solved in (3) by mixing bare alumina support with the supported cupric chloride catalyst. It is clearly suggested in (3) that by reduction of the cupric chloride concentration on the outside surfaces of the supported catalyst and transfer of the released  $\text{CuCl}_2$  to the bare support stickiness of the catalyst particles is decreased and consequently the fluidisation characteristics are improved (see column 3, lines 20 to 48, column 7, lines 54 to 67; Claim 1). In view of this teaching the skilled person faced with the problem of providing a catalyst with excellent fluidisation behaviour in industrial exploitation (cf. point 6.2 above) would first of all contemplate solutions based on the same idea, i.e. reduction of the copper chloride concentration at the surface of the catalyst. As the extent of this reduction is not mentioned in (3), he would firstly determine this parameter and would then consider reducing the amount of particle surface copper chloride to different extents, in particular to a greater extent. Doing so, he would arrive by routine experimentation at the claimed solution. In this context the Board notes that the Appellant has neither contended nor proved that the method disclosed in (3) for depleting the catalyst surface of its active component to some extent (or other known general methods) could not lead to the degree of  $\text{CuCl}_2$  depletion defined in Claim 1.

The fact that not only excellent fluidisation properties but also high DCE yields and high HCl conversions are

aimed at, would not deter the skilled person from carrying out experiments to determine the appropriate extent of the reduction of the  $\text{CuCl}_2$  amount at the catalyst surface since (3) does not contain any information or data suggesting that this reduction would negatively affect the DCE yield or the HCl conversion.

The Appellant's argument that there existed a prejudice against the reduction of copper chloride concentration on the catalyst surface because (3) discloses that  $\text{CuCl}_2$  is more uniformly distributed throughout the particles (cf. column 3, lines 33 to 39) cannot be followed by the Board. This passage concerns the distribution of  $\text{CuCl}_2$  on the particles of the bare alumina support added to the supported catalyst, not the distribution of  $\text{CuCl}_2$  in the diluted catalyst which also contains the supported catalyst particles with a reduced copper concentration at their surface. In this respect the Board observes that the surface atomic concentration of copper defined in Claim 1 results from a statistical measure (XPS-method) which does not permit distinguishing whether the catalyst consists of particles all having a reduced amount of copper at their surface or of a mixture of particles with different copper distributions. Therefore, the fact that the catalyst of (3) consists of such a mixture has no influence upon the preceding finding.

- 6.5 For the reasons given above, the Board considers that the catalyst as defined in Claim 1 of the main request does not involve an inventive step.

#### Auxiliary Request

7. Claim 1 differs from Claim 1 of the main request in that the catalyst is additionally defined by the two alternative methods for its preparation. There are no

objections under Article 123(2) and (3) to this amended claim.

8. According to the established jurisprudence of the Boards of Appeal a claim defining a product in terms of a process is to be construed as a claim to the product as such. These claims are admissible only if the product as such fulfills the requirements for patentability (see for example T 150/82 OJ EPO 1984, 309). In the present case the catalyst per se is considered not to involve an inventive step for the reasons given above.

Furthermore it does not derive from the patent or from the Appellant's arguments that the operative features additionally recited in Claim 1 (in particular the dry impregnation of the preformed catalyst with a strong acid or the dry impregnation of the carrier with a copper salt solution and an acid) are critical for the obtention of a catalyst with the desired properties as regards fluidisation, DCE yields and HCl conversions in industrial exploitation. The Appellant himself attributed these properties to the claimed reduction of the copper amount at the surface of the catalyst.

The Board further notes that the operative features were considered as lacking inventive step by the Opposition Division (cf. point 32 of the decision under appeal) and that this finding was not contested by the Appellant in the Statement of Grounds or during oral proceedings.

Under these circumstances the Board comes to the conclusion that the subject-matter of Claim 1 according to the auxiliary request also does not meet the requirement of inventive step.

9. The dependent claims and the process claims fall with Claim 1 of each request.

**Order**

**For these reasons, it is decided that:**

**The appeal is dismissed.**

**The Registrar:**

**The Chairman:**

**P. Martorana**

**P.A.M. Lançon**