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**Datasheet for the decision  
of 22 January 2013**

**Case Number:** T 0515/10 - 3.3.07

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**Language of the proceedings:** EN

**Title of invention:**  
Novel transition metal phosphide catalysts

**Applicant:**  
IFP Energies nouvelles

**Headword:**  
-

**Relevant legal provisions:**  
EPC Art. 54

**Keyword:**  
"Novelty - all requests (no)"

**Decisions cited:**  
-

**Catchword:**  
-



Case Number: T 0515/10 - 3.3.07

**D E C I S I O N**  
of the Technical Board of Appeal 3.3.07  
of 22 January 2013

**Appellant:** IFP Energies nouvelles  
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**Representative:** IFP Energies nouvelles  
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**Decision under appeal:** Decision of the Examining Division of the  
European Patent Office posted 20 October 2009  
refusing European patent application  
No. 00966987.0 pursuant to Article 97(2) EPC.

**Composition of the Board:**

**Chairman:** J. Riolo  
**Members:** D. Semino  
M.-B. Tardo-Dino

## Summary of Facts and Submissions

- I. The appeal lies from the decision of the examining division announced at the oral proceedings on 15 September 2009 refusing European patent application No. 00 966 987.0.
- II. The application as filed comprised five independent claims, three of which were directed to catalysts including a metal phosphide and a high surface area support, while the remaining two related respectively to a method of hydrotreating a hydrocarbon feed and a process for hydrodesulfurising a hydrocarbon feed, both making use of catalysts of that class.
- III. The decision was based on four sets of claims filed respectively as main request with letter of 11 September 2009 and as auxiliary requests I to III during the oral proceedings on 15 September 2009.

The main request included several independent claims, the first one being directed to a method for preparing a metal phosphide catalyst. Auxiliary request I included among others two independent product claims (claims 1 and 3). Claim 1 of auxiliary request II read as follows:

"1. A metal catalyst comprising: at least one metal selected from the group consisting of Fe, Mo, and W, wherein at least a portion of said at least one metal is in the form of a phosphide; and a high surface area support having a surface area of at least 50 m<sup>2</sup>/g wherein the said at least one metal and said phosphide is dispersed on said high surface area

support wherein the high surface area support is selected from the group consisting of carbon, silica, alumina, titania, thoria, magnesia, zirconia, kaolin, bentonite, kieselguhr, zeolites, and combinations thereof."

Claim 1 of auxiliary request III corresponded to claim 1 of auxiliary request II with the addition that "the metal phosphide complex is deposited on the support in the range of about 10 to about 30% weight complex to support".

IV. The decision of the examining division cited *inter alia* documents D3 (F. Nozaki et al., "Hydrogenation Activity of Metal Phosphides and Promoting Effect of Oxygen", Journal of Catalysis, 1983, pages 207-210) and D3a (F. Nozaki et al., "Chemical Composition of the Catalyst Prepared by Reduction of Nickel Orthophosphate in Hydrogen and Catalytic Activity for Partial Hydrogenation of 1,3-Butadiene", Journal of Catalysis, 1975, pages 166-172) and can be summarised as follows:

- (a) The main request was not to be admitted into the proceedings according to Rule 137(3) and (4) EPC, because claim 1 concerning a method of preparation of a catalyst related to unsearched subject-matter which did not combine with the originally claimed invention (a catalyst and its uses) to form a single general inventive concept.
- (b) Claim 3 of auxiliary request I did not comply with the requirements of Articles 123(2), 84 and 83 EPC and that request did not comply with the requirements of Article 84 EPC in combination with

Rule 43(2) EPC due to the presence of independent product claims 1 and 3.

- (c) Claim 1 of auxiliary requests II and III was not novel with respect to document D3. The argument of the applicant that the disclosure of D3 was not enabling, as reduction in hydrogen at 600°C would not lead to phosphide formation was not convincing, as the applicant had not reproduced the teaching of D3, which explicitly mentioned phosphide formation. The argument that the method of preparation of D3 led to a homogeneous distribution of the phosphide throughout the pellet, so that it could not be regarded as being "dispersed on" the alumina, was also not accepted, as D3 used the term "supported on" and the expressions "dispersed on" and "supported on" were equivalent as regards metal distribution "in" or "on" a support.

- V. The applicant filed an appeal against that decision. With the statement setting out the grounds of appeal, the appellant submitted five sets of claims as main request and auxiliary requests I to IV.

Claim 9 of the main request was identical to claim 1 of auxiliary request II on which the decision was based. Claim 1 of auxiliary request I contained in addition to that a larger group of metals ("Fe, Co, Ni, Mo and W") and the specification that the catalyst is "obtainable by a method for preparing said catalyst consisting of the steps of: impregnating the support with solutions of the metal and phosphorus components optionally drying at 25°C to 200°C, and calcinating in air or

oxygen in the range of 350°C to 750°C so as to intimately mix the components; reducing the resulting material in a hydrogen stream at temperatures between 300°C and 1000°C for formation of phosphide on the support". Claim 1 according to both auxiliary request II and auxiliary request III was identical to claim 9 of the main request. Claim 1 of auxiliary request IV was identical to claim 1 of auxiliary request III on which the decision was based.

In the statement of grounds the appellant declared *inter alia* that experiments were being prepared related to the catalysts of D3 (page 10, first full paragraph).

VI. In a communication sent in preparation to oral proceedings, the Board addressed in detail *inter alia* the issue of novelty of the claimed catalysts with respect to document D3 and indicated that it was equally relevant for claim 9 of the main request and claim 1 according to all auxiliary requests.

VII. Oral proceedings were held on 22 January 2013 in the absence of the appellant, as announced by letter of 3 January 2013.

VIII. As far as relevant to the present decision, the appellant argued essentially as follows:

D3 referred to nickel, cobalt and iron metals which were mixed with a support and the resulting phosphides were dispersed throughout in the support. In contrast, the method according to the invention required that the phosphide was on the support, i.e. dispersed on the high surface area support. Document D3a, cited as

reference in D3, disclosed that the catalyst of D3 were obtained by wet mixing powdered nickel orthophosphate and alumina sol, followed by drying and extrusion, wherein the pellets obtained by extrusion were thereafter calcined and reduced with hydrogen. Hence, it was clear from D3 with the teaching of D3a that the metal phosphide was distributed throughout the pellet, i.e. within the support and not, as required in the claims, dispersed on the support. The consequence of having a homogeneous distribution of the phosphide throughout the pellet and, thus, resulting in a distribution of the phosphide in the support was that not the full amount of the metal phosphide was available for the catalytic reaction. Hence, the examining division was incorrect in equating the term "dispersed on a support" with the term "support on" as used in D3, in particular in view of the fact that D3 explicitly referred to D3a for the preparation of the catalyst and D3a disclosed a wet mixing process followed by drying and extrusion. For those reasons, not only the method claims, but also the product claims according to all requests on file were novel over the disclosure of D3.

IX. The appellant had requested in writing that the decision under appeal be set aside and a patent be granted on the basis of the set of claims of the main request or, in the alternative, according to one of auxiliary requests I to IV, all submitted with the statement of grounds.

## Reasons for the Decision

1. The appeal is admissible.
2. *Main Request - novelty of claim 9*
  - 2.1 Document D3 discloses a metal catalyst comprising iron phosphide supported on an alumina carrier (FeP-Al<sub>2</sub>O<sub>3</sub>), wherein the surface area of the catalyst is 110 m<sup>2</sup>/g (see page 207, first column, lines 24 to 30 and second column, lines 1 to 5).
  - 2.2 During appeal it was not disputed by the appellant that this disclosure anticipates a metal catalyst comprising a phosphide of a metal selected from a group of metals including iron and a high surface area support having a surface area of at least 50 m<sup>2</sup>/g selected from a group of support materials including alumina.
  - 2.3 The only feature of claim 9 of the main request which according to the appellant is not disclosed in D3 is that "the said at least one metal and said phosphide is dispersed on said high surface area support", as in its view in D3 the metal phosphide is distributed throughout the pellet, i.e. within the support and not, as required in the claim, on the support.
  - 2.4 The Board, however, cannot acknowledge that the disputed feature constitutes a difference between the catalyst of D3 and the one of claim 9 of the main request for the reasons which follow.



- 2.4.1 In D3 it is disclosed that the phosphide catalysts are "supported on an alumina carrier" (see page 207, first column, lines 24 to 26).
- 2.4.2 The use of that expression in the catalyst field is unequivocal and leaves no doubt that the metal phosphides are disclosed to be present "on" the support, be it the outer surface of the support particle or the surface of the pores in the case of a porous carrier. This is in line with the whole idea of using carrier (such as alumina) for making supported catalysts, which is based on the disposal of the catalytic material on the surface of the support, so as to make it available for the catalytic reaction.
- 2.4.3 The Board could come to a different conclusion regarding the catalysts disclosed in D3 only in the presence of evidence, which shows that in this particular case, contrary to the expectations based on the disclosure, the catalytic material is not "on" the support. Apparently the appellant recognised the need of supporting evidence and declared in the statement of grounds that experiments were being prepared to demonstrate that the metal phosphide in the catalysts of D3 was not available for catalytic reaction (page 10, first full paragraph). However, such experiments were never submitted to the Board.
- 2.4.4 In the absence of evidence proving the contrary it is therefore concluded that the feature that the metal phosphide is "dispersed on" the support is anticipated by the disclosure of the phosphide catalysts of D3 being "supported on" the alumina carrier.

2.5 No different conclusion can be reached in view of the method of preparation of the catalysts in D3 and in the application under analysis.

2.5.1 In D3 the method of preparation is said to be similar to previously reported ones; some citations are given in this context (see D3, page 207, left column, lines 12 to 14; citation 1 is D3a). The only step of the preparation which is considered worthwhile mentioning in D3 is the reduction of the metal phosphate in hydrogen in order to transform the phosphates in phosphides (page 207, left column, lines 14 to 16 and 29).

2.5.2 In the application it is stated that "a preferred method of preparation for the catalysts involves the reduction of precursor phosphates in a stream of hydrogen" (page 10, lines 12 to 13). Thereafter, one suitable method is described, including impregnation, optionally drying, calcination and reduction (page 10, lines 13 to 18) and it is added that wide variations of that method clear to those skilled in the art can be employed (page 11, lines 3 to 9). No weight is given to a specific method of preparation in order to obtain specific features of the obtained product.

2.5.3 Therefore, not only there is no evidence that by means of different methods of preparation different product features should necessarily be obtained, but both disclosures put the accent on the same crucial process step, namely the reduction in the presence of hydrogen to obtain the desired phosphides, and describe the rest of the preparation procedure as relying on conventional steps well-known to the person skilled in the art.

2.6 For these reasons, the metal catalyst of claim 9 of the main request is not novel over the disclosure of D3.

3. *Auxiliary requests I to IV - novelty of claim 1*

3.1 Claim 1 of auxiliary request I corresponds to claim 9 of the main request with the addition of a longer list of metals (still including iron) and the specification of the method of preparation of the claimed catalyst by means of a product-by-process feature ("obtainable by").

3.1.1 As well established in the case law (Case Law of the Boards of Appeal of the European Patent Office, 6th Edition 2010, II.B.6) the use of product-by-process features is allowed under specific conditions, including in particular that the product must be patentable (i.e. novel and inventive) independently of the method of fabrication. In order to acknowledge novelty of a product therefore it is clearly not sufficient that the method of preparation is different from the ones disclosed in the art, but it is necessary that the product *per se* differs from the known ones.

3.1.2 In the present case the appellant has not provided any evidence that the product obtainable by the method of preparation added to the claim is different from the ones of D3 (see points 2.4 and 2.5, above), so that novelty with respect to the disclosure of D3 cannot be acknowledged for the metal catalyst of claim 1 of auxiliary request I.

3.2 Claim 1 according to auxiliary request II and claim 1 according to auxiliary request III are identical to

claim 9 of the main request. They are therefore not novel with respect to the disclosure of D3 for the same reasons as detailed for the main request (see point 2, above).

3.3 Claim 1 of auxiliary request IV corresponded to claim 9 of the main request with the addition of a range for the quantity of the metal phosphide deposited on the support, namely 10 to 30% weight phosphide complex to support.

3.3.1 In D3 it is disclosed that in each catalyst the metal phosphide content was adjusted to about 20 wt% (page 207, left column, lines 30 to 32), which corresponds to 25% weight phosphide to support.

3.3.2 The disclosed quantity clearly refers to the phosphide supported on the alumina carrier (no other phosphide is mentioned) and falls within the range added to the claim. Therefore, claim 1 of auxiliary request IV is not novel over the catalysts of D3 in view of that specific disclosure in combination with the reasons given for the main request (see point 2, above).

4. As the first independent product claim of all requests on file (claim 9 of the main request and claim 1 according to all auxiliary requests) is not novel over the disclosure of D3, there is no need for the Board to decide on any other issue.

**Order**

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

The appeal is dismissed.

The Registrar

The Chairman

S. Fabiani

J. Riolo