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**D E C I S I O N**  
**of 22 March 2005**

**Case Number:** T 0902/02 - 3.3.1

**Application Number:** 95942179.3

**Publication Number:** 0797560

**IPC:** C07C 5/333

**Language of the proceedings:** EN

**Title of invention:**

Large particle dehydrogenation catalyst and process

**Patentee:**

SHELL INTERNATIONALE RESEARCH MAATSCHAPPIJ B.V.

**Opponent:**

SÜD-CHEMIE AG  
BASF Aktiengesellschaft

**Headword:**

Dehydrogenation Catalyst/SHELL

**Relevant legal provisions:**

EPC Art. 56, 123(2), (3)

**Keyword:**

"Amendments (allowable) - feature originally disclosed - original preference of feature not a prerequisite for amendment"

"Inventive step (no) - improvement not credible - unfair comparative tests - alternative - arbitrary selection"

**Decisions cited:**

T 0020/81, T 0514/88, T 0288/92, T 0680/93

**Catchword:**

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Case Number: T 0902/02 - 3.3.1

**D E C I S I O N**  
**of the Technical Board of Appeal 3.3.1**  
**of 22 March 2005**

**Appellant:**  
(Opponent I)

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**Representative:**

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**Party as of right:**  
(Opponent II)

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**Representative:**

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

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**Representative:**

-

**Decision under appeal:**

Interlocutory decision of the Opposition  
Division of the European Patent Office posted  
3 July 2002 concerning maintenance of European  
patent No. 0797560 in amended form.

**Composition of the Board:**

**Chairman:**

A. J. Nuss

**Members:**

R. Freimuth

R. T. Menapace

## Summary of Facts and Submissions

- I. The Appellant (Opponent I) lodged an appeal on 2 September 2002 against the interlocutory decision of the Opposition Division, posted on 3 July 2002, which found that the European patent No. 797 560 in the form as amended in opposition proceedings satisfied the requirements of the EPC.
- II. Notice of Opposition had been filed by the Appellant and the Opponent II, the latter now being party as of right, requesting revocation of the patent in suit in its entirety on the grounds of Article 100(a) and (b) EPC, in particular on the grounds of lack of sufficient disclosure, of novelty and of inventive step. *Inter alia* the following document was submitted in opposition proceedings:
- (2) US-A-5 171 914.
- III. The decision under appeal was based on an amended set of eight claims, independent claim 1 thereof reading as follows:
- "1. A dehydrogenation catalyst comprising acicular iron oxide and potassium, characterized in that the iron oxide particles have a median longest dimension between 2 and 10 micrometer."
- IV. The Opposition Division held that the invention was sufficiently disclosed and that the documents cited neither anticipated nor rendered obvious the subject-matter of the patent in suit as amended.

Starting from document (2) in the assessment of inventive step, that document described an acicular shape and a particle size of less than 10  $\mu\text{m}$  for iron oxide catalysts. The problem underlying the patent in suit was seen in obtaining an improvement in catalytic activity subject to maintaining a high level of selectivity. On the basis of the test results indicated in the patent specification an effect as regards the catalyst activity was found to have been demonstrated for the claimed particle range of 2 to 10  $\mu\text{m}$ . Document (2) neither taught nor suggested acicular particles having a median longest dimension of that size for achieving this improvement. Therefore the subject-matter claimed was not obvious and involved an inventive step.

- V. The Appellant submitted that the feature of an "acicular" shape of the particles introduced into claim 1 did not satisfy the requirements of Article 123(2) EPC since the Patentee, at the priority date, was not aware of the criticality of that feature because any other configuration would have been suitable as well. Although that shape was originally disclosed as an alternative, any pointer to the particular preference of the acicular shape was lacking in the application as filed which conflicted with the provisions of that Article.

The disclosure in the example of the patent specification was too vague for teaching a successful preparation of the catalysts. The iron oxide used was not precisely identified but labelled merely as Penniman Red Iron Oxide from Bayer AG. The teaching of the prior art, which was referred to in the patent

specification, was also insufficient for preparing the catalyst. Therefore the invention lacked sufficient disclosure.

The Appellant, in the Statement of the Grounds of Appeal, addressed fresh document

(14) US-A-3 904 552.

That document specifically described a catalyst comprising iron oxide and potassium wherein the iron oxide particles were needles approximately 2  $\mu\text{m}$  in size. This disclosure was alleged to be novelty destroying.

With respect to inventive step, the Appellant started from document (2) as the closest prior art which described catalysts comprising micaceous and acicular particles. The problem purportedly underlying the patent in suit was the provision of catalysts having increased activity while maintaining acceptable selectivity. However, the catalysts of document (2), e.g. catalysts D and E, in the same test experiment, were superior in activity and selectivity to catalyst VII according to the patent in suit. Furthermore, the patent in suit did not identify the catalysts tested in respect of their activity as having an acicular shape. The Penniman process indicated in the patent in suit for preparing the tested catalysts did not necessarily result in acicular particles, but could produce particles of any shape. The comparative examples in the patent specification did not reflect the activity of the catalysts according to the closest prior art, namely those comprising micaceous and acicular particles. For all these reasons, the test data on file

did not properly support the purported improvement in activity of the claimed catalysts. Therefore the objective problem underlying the patent in suit was merely the provision of further dehydration catalysts. To identify arbitrarily a particular size of acicular particles known from document (2) was a routine activity for the skilled person without involving an inventive step.

- VI. The Respondent (Proprietor of the patent) submitted that the amendment of claim 1 was allowable under Article 123(2) EPC since the use of "acicular" iron oxide was provided for as an alternative at page 3, line 15 of the application as filed. Any additional requirement, for example a particular preference for this feature in the original application, did not exist under the provisions of that Article.

As to the objection of an insufficiently disclosed preparation of the claimed catalyst, the Respondent submitted that no evidence has been provided by the Appellant that the skilled person could not obtain such iron oxide having the dimensions indicated in claim 1. The patent in suit provided instructions on how to prepare it.

Document (14) was not novelty destroying. That document did not disclose directly and unambiguously the "median longest dimension" of the iron oxide particles as required according to claim 1. Moreover, fresh document (14) was filed late and should not be admitted into the appeal proceedings.

With respect to inventive step, the Respondent started from document (2), in particular from the comparative catalyst in Table 1 thereof, as the closest prior art. The comparative catalyst contained an acicular iron oxide having a needle size of 0.5 to 1  $\mu\text{m}$ . The problem underlying the patent in suit was the provision of dehydrogenation catalysts having improved activity without loss of selectivity. The test data in the patent in suit showed that the claimed catalysts having a median longest dimension of 2  $\mu\text{m}$  were superior in activity to those having a median longest dimension of 0.5 or 1  $\mu\text{m}$ , respectively. Though not explicitly described, the catalysts tested in the patent in suit had an acicular shape since they were prepared according to the Penniman process which necessarily resulted in particles of that type of shape. The figures of the test data given in the patent in suit and those given in document (2) could not be exactly compared for the reason of slight differences in the operation of those tests. There was no incentive, neither in document (2) nor in any other document cited in the proceedings, that would motivate the skilled person to make this modification in size to increase activity while maintaining selectivity. Therefore the claimed subject-matter was not obvious.

Nor was it obvious in case the objective problem underlying the patent in suit was reformulated as providing merely further dehydrogenation catalysts. The size to choose for dehydrogenation catalysts was the common one already indicated in document (2), namely 0.5 to 1  $\mu\text{m}$ . Thus, there was neither an incentive to increase its size to the claimed range.

VII. The Party as of right did not file any submissions as to the substance.

VIII. The Appellant requested that the decision under appeal be set aside and the patent be revoked.

The Respondent requested that the appeal be dismissed.

The Party as of right did not file any request.

IX. Oral proceedings before the Board were held on 22 March 2005 in the absence of the Party as of right which, after having been duly summoned, informed the Board by its letter dated 16 March 2005 that it would not attend. At the end of the oral proceedings the decision of the Board was given orally.

### **Reasons for the Decision**

1. The appeal is admissible.

2. *Amendments (Article 123(2) and (3) EPC)*

2.1 The amendment to claim 1 as granted of defining the shape of the iron oxide as being "acicular" is specifically disclosed on page 3, line 15 of the application as filed.

The Appellant concurred with this finding and acknowledged at the oral proceedings before the Board that the acicular shape of the iron oxide was listed as one of several equivalent alternatives in that section of the original application.



2.2 The Appellant alleged, nevertheless, that the specific disclosure of the "acicular" shape in the application as filed was not sufficient to satisfy the requirements of Article 123(2) EPC since any pointer to the particular preference of this shape was lacking in the original application thereby ignoring the criticality of that feature.

However, the sole requirement, which Article 123(2) EPC provides for amendments to be allowable, consists in prohibiting amendments generating "subject-matter which extends beyond the content of the application as filed". In order to determine whether or not the subject-matter of an amended claim in a patent satisfies this sole requirement it has to be examined only whether that amended claim comprises technical information which a skilled person would not have objectively and unambiguously derived from the application as filed (see decisions T 514/88, OJ EPO 1992, 570, point 2.7 of the reasons; T 288/92, point 3.1 of the reasons and T 680/93, point 2 of the reasons, neither published in OJ EPO).

In the present case the amendment made to claim 1 satisfies that sole requirement of Article 123(2) EPC as set out in point 2.1 *supra* and there is no dispute between the Appellant and the Respondent about that finding.

Hence, the Appellant's allegation that, in order to comply with Article 123(2) EPC, the amendment should satisfy a further requirement, namely that it was an originally preferred embodiment, represents a mere

personal view not supported by the European Patent Convention and, thus, is devoid of merit.

- 2.3 To summarize, the amendment made to claim 1 as granted complies with the requirements of Article 123(2) EPC.

That amendment of claim 1 as granted brings about a restriction of the scope of that claim, and therefore of the protection conferred thereby, which is in keeping with the requirements of Article 123(3) EPC.

3. *Sufficiency of disclosure, Novelty*

The Appellant objected to the sufficiency of disclosure of the invention and, based on document (14), to the novelty of the claimed subject-matter. In view of the negative conclusion in respect of the claimed invention for lack of inventive step as set out in point 4 below, a decision of the Board on these issues is unnecessary. Having regard to the outcome of the appeal, there is also no need for the Board to take a decision whether or not to admit document (14) into the proceedings.

4. *Inventive step*

- 4.1 According to the established jurisprudence of the Boards of Appeal it is necessary, in order to assess inventive step, to establish the closest state of the art, to determine in the light thereof the technical problem which the invention addresses and successfully solves, and to examine the obviousness of the claimed solution to this problem in view of the state of the art. This "problem-solution approach" ensures assessing

inventive step on an objective basis and avoids an *ex post facto* analysis.

- 4.2 The patent in suit is directed to an active and selective dehydrogenation catalyst comprising iron oxide particles and potassium.

Similar dehydrogenation catalysts already belong to the state of the art: document (2) discloses in its claims 1 and 4 catalysts comprising iron oxide and potassium. The iron oxide comprises particles of micaceous shape having a dimension of less than 10  $\mu\text{m}$  preferably in admixture with acicular particles (claim 6; column 4, lines 25 and 26). Those catalysts show high activity and selectivity (column 2, lines 53, 54 and 66; Table I, columns 2 and 3).

For these reasons, the Board considers, in agreement with the Appellant, the Respondent and the Opposition Division, that document (2) represents the closest state of the art, and, hence, the starting point in the assessment of inventive step.

- 4.3 In view of this state of the art the problem underlying the patent in suit, as indicated in the patent specification on page 2, paragraph [0008] and as submitted by the Respondent during the appeal proceedings, consists in providing a dehydrogenation catalyst having improved activity without loss of selectivity.

- 4.4 As the solution to this problem the patent in suit proposes the catalyst according to claim 1 comprising

iron oxide particles having an acicular shape and a median longest dimension between 2 and 10  $\mu\text{m}$ .

The non-restrictive term "comprising" in claim 1 encompasses the presence of any other iron compound (see patent specification paragraph [0025]) and, thus, also the additional presence of e.g. micaceous iron oxide particles as described in document (2).

4.5 The Appellant and the Respondent were divided as to whether or not the evidence presented convincingly showed the successful solution of the problem defined in point 4.3 *supra vis-à-vis* the closest prior art. To demonstrate that the claimed catalysts achieve the purported improvement in activity without loss of selectivity, the Respondent relied in particular on the test report comprised in the specification of the patent in suit.

4.5.1 This test report is on the experimental activity and selectivity data of catalysts according to the invention (examples VII to IX) and of catalysts labelled comparative ("Comp." examples I to VI). The comparative catalysts consist exclusively of acicular particles having a size of 0.5 or 1  $\mu\text{m}$ .

The Respondent alleged that these comparative catalysts reflected the closest prior art since document (2) disclosed, in form of a comparative example, a catalyst consisting of acicular particles having a size of 0.5 to 1  $\mu\text{m}$ , thereby convincingly demonstrating the purported superiority in activity and selectivity of the claimed catalysts.

However, the teaching of the closest prior document (2), which is the starting point in the assessment of inventive step, resides in using catalyst particles having a micaceous shape preferably in admixture with acicular particles. A catalyst consisting exclusively of acicular particles is outside the scope of that teaching (see claim 1); therefore such a catalyst is labelled "comparative" in document (2) and moreover inferior to those catalysts forming part of the teaching of that document (see Table 1). Thus, when comparing the claimed invention with catalysts consisting exclusively of acicular particles, which catalysts do not form part of the teaching of the prior document (2), the Respondent's comparative test report comprised in the patent specification is deficient in that it is not truly reflecting the teaching of the closest prior art, with the consequence that it does not properly demonstrate the successful achievement of the purported improvements of the claimed catalysts vis-à-vis the closest state of the art. Therefore, the Respondent's comparative test report is unfair and must be disregarded in the assessment of inventive step.

- 4.5.2 The Appellant challenged the Respondent's test report also for other reasons, namely that the acicular shape of the catalysts tested was unspecified and that the figures of the test data given in the patent in suit and in document (2) could not be exactly compared. However, there is no need to deal with those objections as the challenged test report is already deficient for the reasons given in point 4.5.1 *supra* and, thus, is not taken into consideration anyhow.

4.6 According to the jurisprudence of the Boards of Appeal, alleged but unsupported advantages cannot be taken into consideration in respect of the determination of the problem underlying the claimed invention (see e.g. decision T 20/81, OJ EPO 1982, 217, point 3, last paragraph of the reasons). Since in the present case the alleged improvement, i.e. increased activity without loss of selectivity, lacks the required adequate experimental support, the technical problem as defined in point 4.3 above needs reformulation.

In view of the teaching of document (2), the objective problem underlying the patent in suit can merely be seen in providing **further** dehydrogenation catalysts.

4.7 Finally, it remains to decide whether or not the proposed solution to that objective problem underlying the patent in suit is obvious in view of the state of the art.

Document (2) describes dehydrogenation catalysts comprising iron oxide and potassium wherein the iron oxide is a mixture of particles with micaceous and acicular shape (claims 1 and 6). The dimension of the acicular particles is neither defined nor restricted to any particular size in that document (see claim 6 and column 4, lines 25 and 26). Therefore the numerical range for the size of 2 to 10  $\mu\text{m}$  indicated in claim 1 of the patent in suit for the acicular particles is within the ambit envisaged by the general disclosure of document (2) which teaches that acicular particles of no defined size are suitable dehydrogenation catalysts.

The Respondent alleged that this numerical range for the particle size was essential for achieving an improvement in catalyst activity without loss of selectivity. However, this purported improvement is not successfully achieved by the claimed catalysts as outlined in point 4.5 above in detail. Thus, not being causal to any particular effect achieved by claim 1, the feature of a particle size of 2 to 10  $\mu\text{m}$  is neither critical nor a purposive choice for solving the objective problem underlying the patent in suit. The act of picking out at random a numerical range for the size of the acicular particles is within the routine activity of the skilled person faced with the mere objective problem of providing an alternative dehydrogenation catalyst. In the present case, the skilled person is all the more guided to pick out acicular particles of the size now claimed as micaceous particles of less than 10  $\mu\text{m}$  are the most preferred in document (2) (see claim 4). Therefore, the choice of a particular size for the iron oxide particles is arbitrary and cannot provide the claimed catalyst with any inventive ingenuity.

- 4.8 The Respondent, at the oral proceedings before the Board, submitted in support of inventive step that the skilled person was deterred from increasing the size to the claimed range of 2 to 10  $\mu\text{m}$  since the catalysts exemplified in document (2) comprised only acicular particles having a size of 0.5 - 1  $\mu\text{m}$ .

It is true, that document (2) describes in its examples catalysts comprising micaceous and acicular particles wherein the latter have a size of 0.5 - 1  $\mu\text{m}$ , this being the only reason for accepting that they do not

anticipate the claimed catalyst. However, as set out in point 4.7 *supra*, the teaching of that document is not confined to its examples but embraces any information contained therein. In the absence of any restriction as to the size of the acicular particles, it cannot be reasonably concluded that the skilled person was deterred from picking out a particle size at random which might well correspond to one as claimed covered by the general teaching of that prior art document. Hence, the facts do not support the Respondent's argument what the Board cannot sanction.

4.9 For these reasons, the subject-matter of claim 1 is obvious in the light of document (2).

5. As a result, the Respondent's request is not allowable for lack of inventive step pursuant to Article 56 EPC.

## **Order**

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

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

The Registrar:

The Chairman:

N. Maslin

A. Nuss