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D E C I S I O N
of 7 July 2005

Case Number: T 0369/02 - 3.3.7

Application Number: 93202596.8

Publication Number: 0587246

IPC: B01J 23/44

Language of the proceedings: EN

Title of invention:
Hydroconversion catalyst

Patentee:
SHELL INTERNATIONALE RESEARCH MAATSCHAPPIJ B.V.

Opponent:
Akzo Nobel N.V.

Headword:

-

Relevant legal provisions:

EPC Art. 56

Keyword:

"Inventive step (yes) - problem and solution - improved effect"

"Experimental evidence suitable and sufficient to support an improved effect (yes)"

Decisions cited:

T 0219/83, T 0197/86, T 0939/92

Catchword:

-



Case Number: T 0369/02 - 3.3.7

D E C I S I O N
of the Technical Board of Appeal 3.3.7
of 7 July 2005

Appellant: Akzo Nobel N.V.
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Decision under appeal: Interlocutory decision of the Opposition
Division of the European Patent Office posted
31 January 2002 concerning maintenance of the
European patent No. 0587246 in amended form.

Composition of the Board:

Chairman: R. E. Teschemacher
Members: B. J. M. Struif
B. L. ter Laan

Summary of Facts and Submissions

I. The mention of the grant of European patent No. 0 587 246 with respect to European patent application No. 93 202 596.8 filed on 6 September 1993 was published on 30 July 1997. The granted patent was based on nineteen claims, claims 1, 9 and 19 being independent and reading as follows.

"1. A catalyst comprising palladium supported on a silica-alumina carrier, which carrier has been prepared from an amorphous silica-alumina starting material having a pore volume of at least 1.0 ml/g."

"9. A process for the preparation of a catalyst as defined in any of the preceding claims, which process comprises preparing a carrier from an amorphous silica-alumina having a pore volume of at least 1.0 ml/g and impregnating the carrier so-formed with palladium by contacting the carrier with a palladium compound in the presence of a liquid."

"19. The use of a catalyst according to any one of claims 1 to 8 or claim 18 as a hydroconversion catalyst, in particular in the hydroconversion of hydrocarbon products of the Fischer-Tropsch synthesis or in the hydroisomerisation of alkanes."

II. On 29 April 1998 a notice of opposition was filed against the granted patent, in which the revocation of the patent in its entirety was requested on the grounds of Article 100(a) EPC due to lack of novelty and lack of an inventive step, respectively. The opposition was supported *inter alia* by the following documents:

D1: GB-A-1 451 617

D2: US-A-3 637 484

D8: Richard K. Oberlander: "Aluminas for Catalysts - Their Preparation and Properties", Applied Industrial Catalysts, vol. 3 (B.E. Leach, ed.), pages 63-112, Academic Press 1984

During the opposition proceedings, an experimental report was submitted with letter dated 25 January 1999, in which the catalyst according to the example of the patent specification was compared with a catalyst differing in the pore volume of the amorphous silica/alumina material.

III. In its interlocutory decision notified by post on 31 January 2002, the opposition division found that the patent as amended according to a set of claims 1 to 19 submitted with letter dated 25 January 1999 as the main request, met the requirements of the EPC. Claim 1 as amended differed from claim 1 as granted by the following addition at the end of claim 1:

"... and comprising alumina in an amount in the range of from 5 to 30% by weight".

IV. The opposition division held that:

(a) The amendments to the main request were in compliance with the requirements of Article 123(2) and (3) and 84 EPC.

- (b) As to novelty, claim 1 of the main request differed from D1 in that a specific selection was made with respect to the kind of the catalyst metal, the carrier material and the pore volume. Thus, the claimed subject-matter was novel over D1.
- (c) As regards inventive step, D1 was considered to represent the closest state of the art since it dealt with hydroconversion catalysts comprising silica-alumina carriers. The problem to be solved over D1 was seen in providing a hydroconversion catalyst showing a high conversion rate and high selectivity. The experimental evidence showed that the higher pore volume of the carrier according to the patent in suit exhibited a high conversion rate and selectivity in the hydroisomerisation of alkanes and the selective hydroconversion of high boiling range hydrocarbons to prepare middle distillates was explicitly mentioned. Therefore, the previously defined problem was effectively solved. The data of the examples of D1 showed that above a pore volume of 0.6 ml/g the yield and the aromatic compounds removed stayed nearly the same, suggesting that the diffusion was limited. D1 therefore taught away from using a high pore volume carrier.

In D2 an alumina/silica carrier having a pore volume of 1 to 2 ml/g was disclosed for the hydrogenation of aromatic hydrocarbons. The skilled person, considering a hydroconversion process, would not have taken into account higher pore volumes for modifying the catalysts of D1.

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

V. On 28 March 2002 the opponent (appellant) filed a notice of appeal against the above decision, the prescribed fee being paid on the same day. In the statement setting out the grounds of appeal filed on 16 May 2002, the appellant no longer contested novelty but argued on lack of an inventive step.

VI. By letter dated 6 June 2005, in reply to a communication of the board, the respondent submitted amended claims as the main request, as well as five auxiliary requests. Furthermore, additional comparative examples and four graphs based on the examples of D1 were submitted.

Claim 1 of the main request corresponded to claim 1 of the decision underlying the appeal.

VII. By letter dated 4 July 2005, the appellant submitted a further document:

D10: US-A-4 045 509

VIII. Oral proceedings were held on 7 July 2005.

The appellant argued in substance as follows:

(a) The novelty of the claimed subject-matter was no longer contested.

(b) Regarding inventive step, D1 could be considered to represent the closest state of the art. The

technical problem addressed in the patent in suit was to provide a catalyst which was excellent for use in a hydroconversion process. However, in the decision under appeal the problem had been reformulated so as to provide a catalyst having improved performance, which problem could not be deduced from the patent in suit. Furthermore, such an improvement had not been shown.

According to the examples submitted with letter dated 6 June 2005, a catalyst comprising 0.8% by weight of Pt by way of comparison, was prepared using hydrochloric acid, whilst a catalyst comprising 0.4% by weight Pd, illustrating the claimed invention, was prepared using nitric acid. It was generally accepted that the activity of a catalyst depended on the conditions of its preparation. According to D8 and D10, the incorporation of chloride in the catalyst support enhanced its effectiveness. In D10, a considerable amount of chloride impregnated in the catalyst support by the use of hydrochloric acid, was still present after the calcination step, which was carried out at temperatures comparable to those in the patent in suit. Since the Respondent argued that the presence of chloride in the final catalyst should be avoided, the use of hydrochloric acid in the comparative experiment was not adequate. Also, the molar ratios of the noble metals were not the same in both catalysts, and since different acids had been used, the examples differed in more than one feature from one another, contrary to the requirements

established in decision T 197/86 (OJ EPO 1989, 371).

Further catalysts prepared according to the test report of 6 June 2005, which comprised the same weight percentage of Pt and Pd (0.8% by weight), were even less appropriate as a basis of comparison since the molar ratio of Pd was much higher than that of Pt. The test results obtained when using those catalysts in hydroisomerisation and in hydrocracking of Fischer-Tropsch products, could therefore not serve as a proper comparison. Hence, an improvement of the claimed catalyst vis-à-vis the prior art had not been shown.

- (c) The experimental data on file concerned only n-heptane hydroisomerisation and the hydrocracking of Fischer Tropsch products. The results of those experiments could not be generalized to apply to all hydroconversion reactions. Hence, it had not been shown that the claimed catalyst displayed an improved performance over the entire claimed range. Therefore, the technical evidence on file was not sufficient to justify the scope of protection for all applications of the claimed catalyst (T 939/92 (OJ EPO 1996, 309)

- (d) Since no improvement had been shown and since the problem as defined could not be considered to have been solved, the problem had to be reformulated so as to provide an alternative catalyst to that of D1. The claimed catalyst was obvious from D1 since each of its features was disclosed therein. In the light of D2, the skilled person would readily

think of making catalysts at the higher end of the pore volume range of D1 so as to arrive at the catalyst now being claimed.

Even if an improved performance in hydroconversion was achieved, this either reflected the result of routine experimentation within the teaching of D1 or it represented a fortuitous result. Since in D2 the diffusion of a high pore volume catalyst was less limited than that of a low pore volume catalyst, the skilled person would use a pore range in the upper limit of D1. Thus, the claimed subject-matter lacked an inventive step.

IX. The arguments of the proprietor (respondent) can be summarized as follows:

- (a) D1 was the closest state of the art and related to a catalyst having a high activity, suitable for the preparation of medicinal oils in high yields. According to the respondent's additional examples filed with letter dated 6 June 2005, the claimed catalyst showed an improved activity and selectivity, in particular a higher total yield, in the hydrocracking of hydrocarbon products of the Fischer-Tropsch synthesis to middle distillates and in the hydroisomerisation of alkanes. Since the molar amount of Pd in the catalyst was slightly lower than that of the Pt catalyst, an even more pronounced effect would be expected at equal molar amounts. The acids were used to provide a homogeneous distribution of the noble metal throughout the catalyst. Nitric acid was used in the preparation of the comparative Pt

catalyst for practical reasons, since the starting platinum compound already contained a high amount of chloride ions, and since chloride was not desired for fear of corrosion problems in the reaction apparatus. Hydrochloric acid was used for the preparation of the claimed Pd catalyst to increase the solubility of the palladium compound. However, the chloride had no effect on the catalyst activity, since practically all remaining chloride was removed during calcination.

In this connection, the reference made by the Appellant to D8 and D10 was not appropriate. The catalyst in D10 was a Friedel-Crafts catalyst, which was quite different from the claimed catalysts and was used together with hydrochloric acid, which, however, caused corrosion problems. The catalyst support of D8 was used in a reforming process in which hydrogen was produced, a process completely different from hydroconversion.

Hence, the technical problem, to provide a catalyst having an improved conversion rate and selectivity in a hydroconversion process, was solved by the claimed subject-matter.

- (b) Since claim 1 related to a catalyst as such, it was irrelevant whether that claim covered a broad range of different uses. It was sufficient, for obtaining the broad protection of a product claim, if that product provided an unexpected technical effect. Such an effect had been shown for the hydroisomerisation of alkanes and the hydroconversion of Fischer-Tropsch products, both

processes being of high commercial interest. Thus, there was no discrepancy between the scope of the claims and what had been demonstrated by evidence.

- (c) As regards obviousness, all catalysts exemplified in D1 were prepared from amorphous silica-alumina carriers having a pore volume of below 1.0 ml/g.

D1 did not show any relationship between yield and pore volume; the positive correlation between the aromatic content removal and pore volume stopped at about 0.6 ml/g. D1 therefore in fact taught away from using a high pore volume carrier. The catalyst of D1 also worked quite well at a low pore volume. Hence, there was no incentive for the skilled person to perform routine experiments within the teaching of D1 to achieve the experimental results submitted in the course of the proceedings.

According to D2, high pore volume carriers offered little advantage over conventional low pore volume supports if the degree of metal dispersion thereon was low. High pore volume carriers had advantages only if the metal was deposited on the carrier by means of ion exchange. Since D1 and the claimed invention both used a conventional impregnation process, D2 did not suggest how to improve the catalyst of D1 so as to arrive at the claimed subject-matter. Furthermore, D2 was directed to a different type of reaction, i.e. the hydrogenation of aromatic hydrocarbons, so that the effect of the claimed catalyst, demonstrated by the

additional experiments could not be expected to result from the teaching of D2.

That conclusion was also valid for the other documents on file. Thus, the claimed subject-matter involved an inventive step.

- X. The appellant requested that the decision under appeal be set aside and that the European patent be revoked.
- XI. The respondent requested that the appeal be dismissed and that the patent be maintained on the basis of the main request (claims 1 to 18) or, alternatively, on the basis of one of the five auxiliary requests, all filed with letter dated 6 June 2005.

Reasons for the Decision

- 1. The appeal is admissible.

Novelty

- 2. Novelty was accepted in the decision underlying the appeal and was no longer contested by the appellant. The board sees no reason to deviate from the decision of the opposition division in that respect.

Inventive step

Closest prior art

3. The patent in suit concerns a hydroconversion catalyst. Such a catalyst is known from D1, which both parties and the opposition division regarded as the closest prior art document. Since D1 is also used in the patent in suit as the starting point for formulating the problem to be solved (column 1, lines 7 to 22), the board sees no reason to deviate from that view, in line with the established case law (Case Law of the Boards of Appeal of the European Patent Office, 4th edition 2001, I.D.3.1).

Problem to be solved

4. D1 discloses a process for the preparation of medicinal oils, wherein a hydrocarbon mixture with an aromatics content of less than 10 % by weight is contacted at elevated temperature and pressure and in the presence of hydrogen with a catalyst containing one or more noble metals from Group VIII on a carrier, which carrier contains 13-15% by weight of alumina, the remainder being silica (claim 1). The catalyst preferably contains 0.05-5% by weight of noble metal (claim 2).
 - 4.1 The noble metals from Group VIII that may be present on the carrier are platinum, palladium, rhodium, ruthenium, iridium and osmium, platinum being preferred. If desired, two or more of these metals may be present. The quantity of Group VIII noble metal present in the catalyst is preferably 0.1-2 wt% and in particular 0.2-

1 wt%. Catalysts with a surface area of 50-500 m²/g and a pore volume of 0.2-1.2 ml/g are preferred (page 2, lines 66 to 77). The starting silica-aluminas of D1 are prepared by precipitating alumina or silica hydrogel and subsequently drying and calcinating the material (page 2, lines 92 to 96). According to the patent in suit, the silica-aluminas prepared in D1 are amorphous materials suitable for use in the preparation of the claimed catalyst (column 2, lines 14 to 19).

- 4.2 In the examples of D1, six catalysts are prepared all of which contain Pt. Examples I to IV illustrate the catalyst carrier of D1, whilst examples V and VI are comparative examples containing only alumina or silica as the carrier material, respectively. The pore volume of the exemplified amorphous silica/alumina carriers is from 0.34 to 0.87 g/ml (examples I to IV, page 5).

Since the carrier of D1 consists of an amorphous silica/alumina having an aluminium content of 13 to 15 % by weight, which is within the range now being claimed, the claimed subject-matter differs from D1 in the combination of Pd and the pore volume of the carrier material.

5. According to the patent in suit, the problem to be solved is to provide a catalyst that is excellent for use in hydroconversion processes (column 1, lines 53 to 56). The term hydroconversion comprises in its broadest sense a reference to conversion processes in the presence of hydrogen and ranging in severity, from hydrocracking to mild hydrogenation processes (column 2, lines 5 to 9). The catalyst may be used in alkane hydroisomerisation and hydrocracking. In particular,

the catalyst may be applied in the selective hydroconversion of high boiling range hydrocarbons to prepare middle distillates, especially the hydroconversion of high boiling range products of the Fischer-Tropsch synthesis process (column 6, lines 24 to 31).

- 5.1 The patent in suit contains one example in which an amorphous silica-alumina of pore volume (H₂O) 1.10 ml/g, was used as the basis for the carrier. The carrier particles were impregnated with an aqueous solution of palladium dichloride and hydrochloric acid, dried and calcined at a temperature of 500°C to yield the final catalyst. In the hydroisomerisation at 340°C of n-heptane to iso-C7 compounds, that catalyst provided a conversion of 67 wt% and a selectivity of 89 wt%.

No further examples, in particular no comparative examples, are present in the patent in suit.

- 5.2 With a letter dated 25 January 1999, the patent proprietor (now respondent) filed experiments showing the properties of a Pd catalyst supported by a carrier having a pore volume of 0.8 ml/g instead of 1.1 ml/g. In the hydroisomerisation at 340°C of n-heptane to iso-C7 compounds, that catalyst had a conversion of 54 wt% and a selectivity of 88 wt%.; at a conversion temperature of 375°C the conversion was 67 wt% and the selectivity 75 wt%.

- 5.3 With a letter dated 6 June 2005, the Respondent submitted additional examples in which an amorphous silica-alumina of pore volume 1.1 ml/g was used as the basis for the catalyst carrier. Although the method was

the same as in the patent-in-suit, the starting material for the silica-alumina carrier was of a different brand. A catalyst was prepared in the same way as described in the patent in suit, but with half the amount (0.4 wt%) of palladium.

A second catalyst was also prepared by impregnating the carrier particles with an aqueous solution comprising hexachloroplatinic acid and nitric acid. The catalyst contained 0.8 wt% platinum.

In the same way as described in the patent in suit, the two catalysts were tested in the hydroisomerisation of heptane. The Pt catalyst provided a total yield (which is calculated by multiplying selectivity and conversion) varying from 13.3 to 3.6% at an isomerisation temperature ranging from 328 to 376 °C, whilst the Pd catalyst provided a total yield varying from 12.1 to 51.0%. That a higher total yield can be achieved by the claimed catalyst was not contested by the appellant.

5.4 Both catalysts were also tested in the hydrocracking of Fischer-Tropsch wax. The Pt catalyst had a selectivity for middle distillates of 91.1 wt% (kerosin 5.1% plus gasoil 86.0%) at a conversion of 50 wt% whilst the Pd catalyst showed a selectivity of 92.9 wt% (3.6% plus 89.3%) under the same conditions. Furthermore, the Pd catalyst produced a smaller amount of the less desired naphtha and C1-C4 products compared to the Pt catalyst.

6. The appellant contested the validity of the test report of 6 June 2005 as a proper comparison in view of the differences in the molar ratios of the noble metals and in the acids used to solve the metal compounds.

6.1 According to decision T 197/86, *supra*, in cases where comparative tests are chosen to demonstrate an inventive step with an improved effect over a claimed area, the nature of the comparison with the closest state of the art has to be such that the effect is convincingly shown to have its origin in the distinguishing features of the invention. For that purpose it may be necessary to modify the elements of comparison so that they differ only by such a distinguishing feature (Reasons, point 6.1.3).

6.2 There has been no dispute that the claimed catalyst differs from D1 by the combination of using Pd as the noble metal and the pore size of the silica/alumina carrier material. Though in all examples of D1 Pt is used and the carrier has a pore size of at most 0.87 ml/g, the tests submitted with letter dated 6 June 2005 differ only in one respect: the catalyst metal used, since the carriers have the same pore size within the claimed range. In the following, reference is made to this test report.

6.2.1 The comparative catalyst comprises 0.8% by weight of Pt corresponding to 0.0041% by mol of Pt, whilst the catalyst illustrating the claimed invention comprises 0.4% by weight of Pd corresponding to 0.0038% by mol of Pd. Hence, the molar amount of metal in the Pd catalyst is smaller than that in the Pt catalyst. It is common general knowledge that the higher the molar loading of the catalytic component, the better the catalytic effect will be. Since the molar amount of Pd in the catalyst is slightly lower than that of the Pt catalyst,

an even more pronounced effect would be expected when using exactly equal molar amounts.

6.3 The other difference objected to by the appellant is that the Pt catalyst is prepared using nitric acid, whilst the Pd catalyst is prepared using hydrochloric acid. The different acids are used in the impregnation solution with which the metal is deposited on the carrier material (claim 15 as granted). Both acids are mentioned as suitable in the patent in suit (see claim 16 as granted).

6.3.1 According to the technical expert present for the respondent at the oral proceedings, nitric acid was used in the preparation of the Pt catalyst since the starting platinum compound (H_2PtCl_6) already contained a high amount of undesired chloride ions which might cause corrosion problems and should therefore be avoided. Hydrochloric acid was however used in the preparation of the Pd catalyst since it was better suited to solubilize the palladium compound ($PdCl_2$). As practically all remaining chloride was removed in the calcination step, the chloride had no particular effect on the catalyst activity. Both acids were merely used to provide a homogeneous distribution of the noble metal throughout the catalyst and in that respect both acids behaved the same.

6.3.2 The appellant argued that, according to D8 and D10, the presence of chloride did have an enhancing effect on the catalyst activity.

D10 relates to a process for the isomerization of less-branched paraffinic hydrocarbons to more-branched

paraffinic hydrocarbons which comprises contacting said less-branched paraffinic hydrocarbons in the vapour phase at a reaction temperature of from about 180° to about 250°F in the presence of hydrogen and a hydrogen halide with a solid catalytic composition comprising a fused salt complex of an aluminium halide selected from the class consisting of aluminium chloride, aluminium bromide and mixtures thereof and a manganous halide selected from the class consisting of manganous chloride, manganous bromide and mixtures thereof; present on the surfaces of a porous, refractory inorganic oxide carrier; said solid catalytic composition being formed by heating a composite mixture of the halide salt components of the fused salt complex to a temperature above the melting point of the composite, depositing the melted composite on the carrier surfaces and cooling of the carrier containing the melted composite to a temperature below the melting point of the fused salt complex (claim 1).

According to D10, the catalyst activity can be enhanced, if the catalyst support is chlorided prior to deposition of the fused salt complex thereon. This pre-chloriding of the support can be carried out by a variety of techniques. One method involves impregnating the support with an aqueous solution of hydrochloric acid, ammonium chloride or metal chloride salt. Another suitable pre-chloriding technique involves pre-treatment with aluminium chloride. A pre-chlorided support preferably contains 0.5 to 5 wt% chloride ion based on support weight (column 5, lines 27 to 46). An exemplified carrier chlorided by impregnation with hydrochloric acid has a chloride content of 1.6% by weight (column 10, line 22).

6.3.3 The catalyst used in D10 comprises fused salt complexes based on aluminium chlorides (so-called Friedel-Crafts catalysts), which is a completely different type of catalyst from that now being claimed. In illustration of this uncontested fact, in the example (step a) of the patent in suit, the carrier is not separately pre-treated with hydrochloric acid; hydrochloric acid is only used in a subsequent step as a component of the impregnation solution. Furthermore, the starting carrier material used in the examples of D10 is a commercial gamma alumina and not an amorphous silica-alumina carrier having a low amount of alumina. In addition, the exemplified calcination temperature in D10 is 900°F, corresponding to 482°C, and thus lower than the calcination temperature of 500°C used in the patent in suit and in the later filed examples. These differences may serve to explain the relatively high remaining amount of chloride in the catalysts of D10.

6.3.4 The advantageous effect ascribed to the presence of chloride in the carrier of D10 cannot be seen isolated from the context of preparing a Friedel-Crafts catalyst which contains aluminium chlorides and other metal halides as catalytic components. Furthermore, in D10, hydrogen chloride has to be present during the isomerization. Consequently, the presence of chlorides is required for the functioning of that type of catalyst. Therefore, the teaching of D10 cannot be applied in a general way to the catalysts now being claimed.

- 6.3.5 According to D8, the addition of chloride in alumina carriers enhances reformer catalysts (pages 104 and 105: point 4. Surface Chemistry of Aluminas). According to the technical expert present for the respondent, the claimed catalyst was a hydroconversion catalyst which made use of hydrogen, whilst by a reformer catalyst hydrogen was produced so that entirely different catalysts were concerned. That explanation has not been contested by the appellant.
- 6.3.6 From the above it follows that the catalysts and their preparation disclosed in D10 and D8 are so different from the claimed catalysts and their preparation that any effect related to the presence of chloride disclosed in those two documents, cannot be generalized and applied to the catalysts prepared according to the patent in suit and in the supplementary test reports.
- 6.4 In addition, the comparative catalyst illustrates the effect of the distinguishing feature of the claimed subject-matter over D1 and therefore fulfils the requirements as laid down in T 197/86, *supra*.
- 6.5 Therefore, the appellant has not shown that the differences in the preparation of the comparative catalysts (nitric acid instead of hydrochloric acid; lower molar amount of Pd than that of Pt) would render the experiments unsuitable for a proper comparison of the closest prior art document, D1, and the claimed catalyst.
- 6.6 In view of the above, the board comes to the conclusion that the experiments filed in the test report of 6 June 2005, are convincing proof of the improved properties

of a catalyst containing Pd instead of Pt in the hydroisomerisation of n-heptane and in the hydrocracking of Fischer-Tropsch wax.

7. A further objection raised by the appellant was that an improvement of the catalyst properties could not be deduced from the application as filed and hence a corresponding reformulation of the problem to be solved was not allowable.

- 7.1 The usefulness of the claimed catalyst in hydroconversion processes was mentioned in the patent in suit as well as in the application as filed (claim 19). Its excellent properties as well as its particular suitability for the hydroisomerisation of alkanes and in the hydrocracking of Fischer-Tropsch products was emphasized (application as filed, page 2, lines 11 to 15, page 8, line 33 to page 9, line 4). In the example, the high selectivity and high conversion in the hydroisomerisation of n-heptane are demonstrated. On that basis, the skilled person might expect the catalyst to have an improved performance over the prior art catalysts.

From the above it follows that the technical effect shown in the experimental reports is closely related to the use of the catalyst as indicated in the application as filed. In the present case, the formulation of the problem to be solved, so as to provide an improved catalyst, could be inferred from the description as filed and therefore does not go beyond the original disclosure.

- 7.2 Moreover, it is in line with the general patent practice for establishing an inventive step over a specific prior art disclosure that the proprietor can rely on such a use as originally disclosed and on experiments filed later which show an enhanced effect in that respect (Case Law, *supra*, I.D.4.5 and Singer/Stauder, The European Patent Convention, vol. 2. third edition 2004, Article 123, notes 63-66).
- 7.3 Therefore, the board cannot follow the appellant's argument that the formulation of the problem to be solved by the claimed subject-matter in the sense of an improvement over D1, was contrary to Article 123(2) EPC.
- 7.4 Hence, the problem to be solved by the claimed subject-matter over D1 can be seen in providing a hydroconversion catalyst having improved properties in the hydroisomerisation of alkanes and in hydrocracking Fischer-Tropsch products to middle distillates.

Solution of the problem

8. As can be seen from point 6.6 above, the board is satisfied that the problem so defined is effectively solved.
- 8.1 However, the appellant was of the opinion that the few comparative experiments on file could not be generalized to all possible applications in support of an inventive step for the broad product claim. In that respect reference was made to T 939/92, *supra*.

8.1.1 The question dealt with in T 939/92 (Reasons 2.4 to 2.6), was, whether all chemical compounds covered by the claim had a specific technical property; in particular, whether all claimed compounds, which were broadly defined as "optionally substituted", had herbicidal activity, whereas the experimental evidence was only restricted to a relatively small number of compounds. In T 939/92, the board, having regard to the common general knowledge that the influence of structural modifications on the desired herbicidal activity was unpredictable, expressed its doubts that all of the claimed compounds, which could be substituted by absolutely everything, would possess herbicidal activity (Reasons 2.6.5). Therefore, the board was not satisfied that substantially all compounds were likely to be herbicidally active, so that the claimed subject-matter extended to compounds that were not inventive.

8.1.2 In the present case, the claimed catalyst is limited to the presence of Pd and a specific carrier having a large pore volume. Therefore, the claimed subject-matter is not as loosely formulated as in decision T 939/92, but it refers to a specific type of catalyst. Moreover, in decision T 939/92, the board had, on the basis of common general knowledge, found it plausible on the basis of specific technical considerations that a number of claimed compounds did not have a herbicidal effect. However, in the present case, it has never been contested that the claimed catalysts are generally suitable for hydroconversion processes.

8.1.3 Furthermore, hydroisomerisation is a reaction that is rather different from the hydrocracking of Fischer-Tropsch products to middle distillates. Therefore, the improvement of the claimed hydroconversion catalyst is illustrated by two applications which in chemical nature are removed from each other. Since there is no evidence on file that a catalyst within the definition of the claimed subject-matter was not effective in hydroconversion processes, the onus of proof in this respect lying with the opponent (appellant) (T 219/83, OJ EPO 1986, 211), the board considers it plausible that the desired effect will occur over a broad range of applications supporting the presence of an inventive step.

8.2 Thus, the experimental evidence submitted by the respondent meets the general principles developed by case law and further experimental evidence for other applications is not required to demonstrate the effective solution of the above-defined problem.

Obviousness

9. It remains to be decided whether the claimed subject-matter is obvious having regard to the documents on file.

9.1 The aim of D1 is to provide a process for the preparation of medicinal oils, which process is different from the hydroisomerisation of alkanes and the hydrocracking of Fischer-Tropsch products, as confirmed by both parties. The appellant argued that the skilled person would routinely perform experiments at the upper end of the pore volume range in order to

avoid the occurrence of diffusion limitation. However, the examples of D1 do not show any relation between the catalyst performance and the pore volume above a pore volume of 0.6 g/ml, as elucidated by graphs submitted with the respondent's letter dated 6 June 2005. Consequently, there was no incentive for the skilled person to perform experiments at the upper end of the pore volume range disclosed by D1. The combination of a high pore volume carrier with palladium as the noble metal, in order to provide an improved performance of the claimed catalyst, is even less evident. Thus, on the basis of D1, the improvement in the catalyst performance could not be foreseen. Hence, the claimed subject-matter is not rendered obvious by D1 alone.

- 9.2 D2 discloses a pelleted catalyst composition having a high activity for the hydrogenation of aromatic hydrocarbons, which comprises: 1. a heterogeneous carrier composite of about 10-50 weight percent of a silica-alumina cogel or copolymer having a $\text{SiO}_2/\text{Al}_2\text{O}_3$ weight ratio of about 50/50 to 85/15 dispersed in a large pore alumina gel matrix, the composite carrier having a surface area between about 200 and 700 m^2/g , and a pore volume of about 0.8-2.0 ml/g, with about 0.3-1 ml/g of said pore volume being in pores of diameter greater than 500 Å; and 2. A minor proportion of a platinum group metal selectively dispersed by cation exchange on said silica-alumina cogel or copolymer from an aqueous solution of a platinum group metal compound wherein the platinum group appears in the cation (claim 1). In all examples a Pt catalyst is used.

9.2.1 D2 is mainly directed to the preparation of a catalyst having a platinum group metal that is highly dispersed throughout a high pore volume carrier material. A high dispersion is achieved by applying an ion-exchange technique using an aqueous solution of a noble metal tetramminohydroxide complex (column 4, lines 24 to 29). However, depending on the type of feedstock employed, the reaction temperature and the pore characteristics of the support, diffusion limitation may render a substantial portion of the highly dispersed noble metal relatively unavailable (D2, column 1, lines 58 to 65). According to D2, diffusion limitation may be avoided by the combined use of a high pore carrier material and the ion-exchange technique for dispersing the noble metal (D2, column 2, lines 27 to 30).

9.2.2 The catalysts of D1 and of the patent in suit are, however, prepared by conventional impregnation (D1, page 2, lines 82 to 87 and examples; patent in suit, claim 9 as granted), so that is not evident that the use of a high pore volume carrier, as taught in D2 for the ion-exchange technique, would lead to an improvement.

Moreover, the hydrogenation of aromatic hydrocarbons, for which the catalysts of D2 are intended (D2, claim 1), is uncontestedly a different process from the ones specifically indicated in the patent in suit (see point 7.1 above). Although D2 mentions the possible use of Pd as well as Pt (column 4, lines 31 to 38), in all the examples Pt is used, and there is no teaching regarding any effect that the use of Pd might have on the catalyst properties regarding the

hydroisomerisation of alkanes and the hydrocracking of Fischer-Tropsch products.

9.2.3 In view of the above, it has to be concluded that D2 does not provide any incentive to modify the catalyst of D1 in the direction of the claimed catalyst.

10. The other documents cited during the proceedings are not more relevant than those analysed above and have not been discussed during the oral proceedings. In particular, none of those documents discloses the combination of Pd with an amorphous silica/alumina carrier having a pore volume above 1 ml/g in order to improve the catalyst properties. Hence, the subject-matter of claim 1 is inventive.

10.1 The same considerations as outlined for claim 1 apply *mutatis mutandis* to process claim 9 and use claim 18 corresponding to original claim 19 which refer back to claim 1.

10.2 From the above it follows that the claimed subject-matter involves an inventive step (Article 56 EPC).

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.
2. The case is remitted to the department of first instance with the order to maintain the patent in the following version:
 - claims 1 to 18 filed with letter dated 6 June 2005 as the main request
 - description: as underlying the decision under appeal.

The Registrar:

The Chairman:

C. Eickhoff

R. Teschemacher