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**D E C I S I O N**  
of 23 July 1998

**Case Number:** T 0350/95 - 3.3.5

**Application Number:** 88200704.0

**Publication Number:** 0288112

**IPC:** B01J 29/08

**Language of the proceedings:** EN

**Title of invention:**

Process for the preparation of modified zeolites

**Patentee:**

Shell Internationale Research Maatschappij B.V.

**Opponent:**

Akzo Nobel N.V.

**Headword:**

Modified zeolites/SHELL

**Relevant legal provisions:**

EPC Art. 84, 54, 56

**Keyword:**

"Novelty (yes), product is not the inevitable result of the disclosed process of preparation"

"Inventive step (main request, no), arbitrary choice from a broad class of products made available"

**Decisions cited:**

T 0666/89, T 0026/85, T 0301/87

**Catchword:**

-



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Chambres de recours

Case Number: T 0350/95 - 3.3.5

**D E C I S I O N**  
of Technical Board of Appeal 3.3.5  
of 23 July 1998

**Appellant:**  
(Opponent)

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6824 BM Arnhem (NL)

**Representative:**

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

Shell Internationale Research  
Maatschappij B.V.  
Carel van Bylandtlaan 30  
2596 HR Den Haag (NL)

**Representative:**

-

**Decision under appeal:**

Interlocutory decision of the Opposition Division  
of the European Patent Office posted 9 March 1995  
concerning maintenance of European patent  
No. 0 288 112 in amended form.

**Composition of the Board:**

**Chairman:** R. K. Spangenberg  
**Members:** M. M. Eberhard  
M. B. Günzel

## Summary of Facts and Submissions

- I. European Patent No. 0 288 112 based on application No. 88 200 704.0 was granted on the basis of ten claims.
- II. The Appellant (Opponent) filed a notice of opposition requesting revocation of the patent on the grounds of lack of novelty and lack of inventive step. During the opposition proceedings, the parties relied inter alia on the following citations:
- D1: US-A-3 706 694,  
D2: US-A-3 654 185,  
D6: US-A-3 130 007.
- III. In an interlocutory decision posted on 9 March 1995, the Opposition Division considered that the patent in an amended form met the requirements of the EPC. The decision was based on amended claims 1 to 6 submitted on 16 January 1995. Claim 1 thereof read as follows:
- "1. Process for hydrocracking hydrocarbons which comprises contacting the hydrocarbons with a catalyst at a temperature in the range from 250 to 500°C, a pressure of up to 300 bar and a space velocity between 0.1 and 10 kg feed per liter of catalyst per hour (kg/l.h), wherein the catalyst comprises a modified zeolite Y having a unit cell size between 2.421 and 2.440 nm, a binder and at least one hydrogenation component of Group 6 metal and/or at least one hydrogenation component of a Group 8 metal, which modified zeolite Y has been prepared by treating a zeolite Y having an alkali oxide/aluminium oxide molar ratio of at most 0.05 and a sodium oxide content of at

most 2% by weight with a solution of a multi-valent metal salt having a cationic radius between 0.06 and 0.10 nm and calcining the thus treated zeolite, with the proviso that the multi-valent metal salt is not a zinc salt."

In the decision, the Opposition Division held that the subject-matter of claim 1 was new over the disclosure of D1 since D1 did not state the unit cell size of the modified zeolite and the Appellant had not shown that calcination of the multivalent metal ions-containing zeolite Y of D1 necessarily led to the claimed unit cell size. The technical problem of the patent in suit was seen in the simultaneous production of gasoline and middle distillates from hydrocarbons, with low gas formation. In the absence of documentary proof the Opposition Division did not accept that lowering the unit cell size of the zeolite was known to favour the middle distillate production. It held that the present process was not suggested by D1 which disclosed no directly comparable product information.

IV. The Appellant lodged an appeal against this decision and relied on two further documents, namely EP-A-0 028 938 (D7) and US-A-4 446 008 (D8) in the statement of grounds of appeal. On 13 July 1998 the Appellant submitted an experimental report concerning the reworking of example 1 of D8.

Oral proceedings were held on 23 July 1998. At the oral proceedings the Respondent submitted amended claims 1 to 4 as an auxiliary request. Claim 1 of the auxiliary request differs from claim 1 of the claims filed on 16 January 1995 (hereinafter the main request) in that the phrase following the words "at most 2% by weight" has been replaced by "with a solution of a gallium(III) salt and calcining the thus treated zeolite."

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

The experimental evidence filed on 13 July 1998 should be admitted into the proceedings in view of its relevance. The reason for its late submission was that until receipt of the summons to oral proceedings the Appellant was of the opinion that a reworking of example 1 of D8 was not necessary. The claims of the main request did not meet the requirements of Article 84 EPC because they were not supported by the description which exemplified the use of only one multivalent ion having the required ion radius.

The subject-matter of claim 1 of the main request lacked novelty over the disclosure of D1. There was an overlap between the sodium oxide range of less than 2 wt% disclosed in D1 and the sodium oxide ranges derivable from the  $\text{Na}_2\text{O}/\text{Al}_2\text{O}_3$  molar ratio of 0.05 or less indicated in claim 1, taking into account the well-known  $\text{SiO}_2/\text{Al}_2\text{O}_3$  ratio of zeolite Y. The skilled person reading D1 would have seriously contemplated lowering the sodium oxide content to an extent within the range of overlap since D1 taught that as much as possible of the sodium was exchanged and sodium was well-known to poison the catalyst. Therefore, D1 disclosed the use of a starting zeolite with a  $\text{Na}_2\text{O}/\text{Al}_2\text{O}_3$  molar ratio of 0.05 or less. The claimed unit cell size was also inherently taught in D1 since the polyvalent metal ion-containing zeolite of D1 was subjected to the same calcination temperature as in the patent in suit for an even longer period. As the patent in suit did not disclose that the unit cell size reduction depended on the kind and amount of polyvalent metal present in the zeolite and on the unit cell size of the starting zeolite, it had

to be assumed that a reduction of unit cell size to a value falling within the claimed range had also occurred in D1. The unit cell size stated in claim 1 was thus the inevitable result of carrying out the teaching of D1.

The teaching of D8 also destroyed the novelty of the claimed process. The starting zeolite had a Na<sub>2</sub>O content of 0.4 wt% and a Na<sub>2</sub>O/Al<sub>2</sub>O<sub>3</sub> molar ratio of 0.028. As calcination was performed under the same conditions as in the patent in suit the reduction in unit cell size was inevitably within the claimed range. Furthermore, reworking of example 1 of D8 as described in the evidence submitted on 13 July 1998 led to a unit cell size falling within the claimed range.

Concerning inventive step, the Appellant argued that the closest prior art D1 already disclosed the simultaneous production of gasoline and middle distillates. Therefore, this could not be the technical problem with respect to D1. Furthermore, this problem was not deducible from the patent application. No conclusion could be drawn from example 8 as to the selectivity for gasoline and middle distillates nor could it be deduced therefrom that the gas formation was lower than in D1, since there was no comparison with known hydrocracking catalysts and there was no proof that the gas production would have been high in D1. The Respondent's arguments that high amounts of liquid and low gas formation would likely also be obtained with the metals other than gallium was highly speculative and not proven. It was also not derivable from the patent in suit that the Na<sub>2</sub>O/Al<sub>2</sub>O<sub>3</sub> ratio and the unit cell size contributed to the performance of the catalyst in hydrocracking.

VI. The Respondent presented inter alia the following arguments:

The Appellant's experimental evidence of 13 July 1998 submitted only 10 days before oral proceedings should not be admitted into the proceedings. It allowed no possibility for verification without further investigation being required and it did not represent a true reworking of Example 1 of D8. The objection under Article 84 EPC raised by the Appellant had not been properly substantiated and should be disregarded.

As regards novelty with respect to D1, the combination of the Na<sub>2</sub>O content with the alkali oxide/alumina ratio and the final unit cell size was not directly and unambiguously derivable from D1. D1 did not disclose a broad range of alkali oxide/alumina ratios but only the maxima and minima possible for the prepared zeolites of the examples, ie from 0.083 to 0.136, which lay outside the upper limit of 0.05. The Appellant had neither shown that the skilled person would have seriously contemplated the claimed combination of features nor provided experimental evidence to substantiate its assertion that the unit cell size of claim 1 was the inevitable result of carrying out the teaching of D1. This assertion was flawed since the unit cell size reduction during calcination varied depending on the kind and amount of metal present in the zeolite. Furthermore, D1 did not mention the unit cell size of the starting zeolite and, as shown by D6, the Y zeolites of the first generation could have a high unit cell size. A zeolite Y with a high unit cell size would not have inevitably led to the claimed unit cell size after calcination.

D8 was not prejudicial to the novelty of the claimed process. There was no teaching anywhere in D8 of the unit cell size. In the absence of experimental evidence it could not be asserted that it lay within the claimed range, in particular when bearing in mind that a significant proportion of smaller framework aluminium ions had been replaced by larger iron ions. Furthermore, D8 was silent as to the unit cell size of the starting Y zeolite.

D1 represented the closest prior art. The interesting properties of the modified zeolite were derivable from example 8 of the patent in suit. The low temperature of 338°C required for a conversion of 70 wt% showed the good activity of the catalyst composition and this example also evidenced the low gas production. In view of the date of D1, it could be concluded that in the process according to D1 the gas production was likely to be high. The problem with respect to D1 was to provide a hydrocracking process which gave a good yield of liquid products with less gas formation. This problem was solved by the combination of sodium content, alkali oxide/alumina ratio and unit cell size recited in claim 1. It was likely that the results obtained in example 8 of the patent in suit with gallium would have also been achieved with the other metals. There was no suggestion in the cited documents that the said combination of features would have solved this problem.

Concerning the auxiliary request the Respondent argued that the relevant technical problem was to obtain good yields in liquid products with less gas formation and that this problem was solved by using a catalyst composition including the gallium-containing zeolite as defined in claim 1. D2 taught that incorporation of aluminium ions into the ammonium exchanged Y zeolite and subsequent calcination caused a substantial loss of



crystallinity and structural damage. As gallium like aluminium belonged to Group III, the skilled person would not have been encouraged to use gallium as trivalent metal in order to solve the said problem.

VII. The Appellant requested that the decision under appeal be set aside and that the patent be revoked. It withdrew its request for reimbursement of the appeal fee.

The Respondent requested, as a main request, that the appeal be dismissed and that the patent be maintained in the amended form maintained by the Opposition Division. As auxiliary request, the Respondent requested that the patent be maintained on the basis of the auxiliary request as filed in the oral proceedings. As a further auxiliary request, the Respondent requested that the experimental evidence filed with the Appellant's letter dated 13 July 1998 not be admitted into the proceedings. If it were to be admitted, the Respondent requested postponement of the oral proceedings and apportionment of costs.

## **Reasons for the Decision**

1. The appeal is admissible.

### *Main request*

2. The Board concurs with the finding in the decision under appeal that claims 1 to 6 of the main request meet the requirements of Article 123(2) and (3) EPC. This was not disputed by the parties. As regards the Appellant's objection concerning the broadness of claim 1 and its lack of support by the description (Article 84 EPC), the Board observes that lack of

support as such is not a ground of opposition and that the alleged lack of support does not arise out of the amendments made to the granted claims. Therefore, this objection cannot be considered here (see also T 301/87, OJ EPO 1990, 335, points 3.4 to 3.8 of the reasons).

3. The Appellant has contested that the subject-matter of claim 1 was novel over the disclosure of D1.

D1 discloses a process for hydrocracking hydrocarbons by contacting the hydrocarbons with a catalyst at temperatures and pressures falling within the ranges claimed in claim 1 of the patent in suit. It was not contested that the space velocity also lies within the claimed range (see column 5, lines 26 to 41). The catalyst used in this process comprises a stabilised zeolite, a binder and at least one hydrogenation component of a Group VI metal and a group VIII metal, for example Mo and Ni (see claim 19, examples 3 and 4). The stabilised zeolite is prepared by incorporating at least one stabilising polyvalent metal cation such as iron, cobalt and nickel into the ammonium form or hydrogen form of the zeolite by ion-exchange, and subjecting the so obtained zeolite to calcination. The starting hydrogen and/or ammonium exchanged zeolite has a  $\text{SiO}_2/\text{Al}_2\text{O}_3$  molar ratio of at least about 3 and contains less than 3 wt% sodium. It is in particular an ammonium zeolite Y containing less than 2 wt%  $\text{Na}_2\text{O}$ . In example 3, the starting ammonium zeolite Y contains 1.8 wt%  $\text{Na}_2\text{O}$  and the cobalt-containing zeolite Y is calcined at  $649^\circ\text{C}$  for 6 hours (see claims 1, 7, 8, 15 and 19; column 3, lines 45 to 54; column 5, lines 51 to 65; column 7, example 3). Therefore, the sodium oxide content of the zeolite Y used in the preparation of the stabilised zeolite of D1 also falls within the range indicated in claim 1.

It follows from the above that D1 discloses all the features recited in amended claim 1 except the alkali oxide/aluminium oxide molar ratio of the starting zeolite used to prepare the modified zeolite and the unit cell size of the modified zeolite, which both are not expressly mentioned in D1. The question arises whether or not D1 implicitly discloses these features.

- 3.1 It was well known at the date of D1 that zeolite Y usually exhibits a  $\text{SiO}_2/\text{Al}_2\text{O}_3$  molar ratio of between 3 and 6. This is in particular disclosed in D6 which is referred to in D1 (see D1, column 2, lines 6 to 10). The Appellant's and Respondent's calculations based on the known composition of zeolite Y show that the upper limit of the alkali oxide/aluminium oxide ratio stated in claim 1 corresponds to **maximum** contents of  $\text{Na}_2\text{O}$  of from 1.09 wt% to 0.67 wt% (or 0.92 wt% to 0.60 wt%) for  $\text{SiO}_2/\text{Al}_2\text{O}_3$  molar ratios varying from 3 to 6 respectively, the values in parentheses being those calculated by the Appellant for the ammonium form of the Y zeolite. As the corresponding ranges lie within the broader range of **less than 2 wt%  $\text{Na}_2\text{O}$**  disclosed in D1 for the ammonium zeolite Y, the question whether or not the alkali oxide/aluminium oxide ratio of 0.05 stated in claim 1 is implicitly disclosed in D1 depends on whether or not the skilled person would have seriously contemplated carrying out the teaching of D1 within the range of overlap (see T 666/89, OJ EPO 1993, 495 and T 26/85, OJ EPO 1990, 22). In the Board's judgement, the skilled person reading D1 would have seriously contemplated lowering the  $\text{Na}_2\text{O}$  content of the starting zeolite Y to at least the maximum values indicated above for the following reasons. D1 teaches that the polyvalent cation is preferably incorporated into the ammonium or the hydrogen form of the zeolite, ie after exchange of the alkali metal form of the zeolite with ammoniacal or mildly acidic solutions and/or partial calcination of the ammonium form

sufficient to convert it to the hydrogen form (see column 2, lines 54 to 59). Sodium is well-known to have a poisoning effect for the catalyst as indicated by the Appellant and not contested by the Respondent. It is not suggested in D1 that sodium oxide contents lower than the content of 1.8 wt% disclosed in example 3 should be avoided, and the incorporation of polyvalent cations is said to stabilise the zeolite. D1 thus contains no information which would have dissuaded the skilled person from practising the teaching of D1 with sodium oxide contents lying within the range of overlap.

- 3.2 As regards the unit cell size, the Appellant's arguments that the claimed unit cell size would be inevitably achieved by following the teaching of D1, in particular by calcining the polyvalent cation-containing zeolite under the conditions used in example 3, ie 649°C for 6 hours, are not convincing for the following reasons. As indicated by the Respondent, the unit cell contraction during the calcination step depends not only on the temperature and duration of the calcination but also on the kind and amount of polyvalent metal cations. This assertion is credible as, on the one hand, the examples of the patent in suit show that modified zeolites having different unit cell sizes are obtained by using the same starting zeolite Y and the same calcination conditions but different polyvalent cations and, on the other hand, part of the polyvalent metal may be introduced into the framework. Furthermore, the Respondent's argument that the final unit cell size is not inevitably achieved by carrying out the process described in D1 if the starting zeolite Y has a unit cell size in the upper part of the range indicated in D6, such as about 24.87 Å (see D6, column 14, last paragraph) is plausible and was also not contested by the Appellant. In this context the Board notes that the unit cell size of the starting

zeolite used in the examples of the patent in suit was 24.56 Å, ie well below the said high value. In addition, although D1 implicitly teaches the alkali oxide/aluminium oxide molar ratio stated in claim 1 (see point 3.1 above) it also discloses higher ratios (ie 0.083 to 0.136 in example 3 for a Na<sub>2</sub>O content of 1.8 wt% and a SiO<sub>2</sub>/Al<sub>2</sub>O<sub>3</sub> ratio in the range from 3 to 6), and an alkali oxide/aluminium oxide molar ratio of not greater than 0.05 has to be chosen in combination with a certain amount of polyvalent metal cation and with a certain unit cell size of the starting zeolite Y in order to obtain the claimed unit cell size. In these circumstances and in the absence of evidence from the Appellant to support its allegation that the process of D1 would inevitably lead to a modified zeolite having the unit cell size stated in claim 1, the Board is not convinced that the preparation of the stabilised zeolite as disclosed in D1 **inevitably** results in a final zeolite having the claimed unit cell size. Therefore, a zeolite with the claimed unit cell size is not implicitly disclosed in D1 and the process of claim 1 is new over the disclosure of D1.

4. For the assessment of inventive step, both the Appellant and the Respondent considered that D1 represents the closest prior art. The Board can accept that D1 is an appropriate starting point for the determination of the technical problem solved by the claimed process.
- 4.1 D1 has been analysed in point 3 above. The catalysts of D1, in particular the catalyst of examples 3 and 4, were tested for catalytic activity in the hydrocracking of a synthetic gas oil and the yield of 49°C-171°C boiling gasoline is given in Table 2 of column 8. D1 discloses that the catalytic properties of the catalyst compositions depend on the amount of stabilised zeolite therein and that compositions containing minor amounts

of the stabilised zeolite exhibit a lower preference for gasoline range hydrocarbons and a higher selectivity for midbarrel range fuels (see column 4, lines 41 to 53). D1 further discloses that hydrocracking temperatures between 343 and 454°C are particularly attractive for the production of gasoline and midbarrel range hydrocarbons in hydrocracking systems (see column 5, lines 26 to 31).

The Respondent argued that the technical problem solved by the claimed process with respect to the hydrocracking process of D1 was the provision of a hydrocracking process which gives a good yield of liquid products with less gas production. However, this was contested by the Appellant, who argued that such a problem was not derivable from the patent application and that the alkali oxide/alumina ratio and cell unit size had not been shown to contribute to the performance of the catalyst (see point V above).

The Board observes that, according to the description of both the patent application and the patent in suit, zeolites of the Y-type with interesting properties can be produced by modifying low alkali oxide-containing zeolites with certain metal salts followed by a calcination treatment, which zeolites are of importance in the preparation of hydrocracking catalysts. However, the description contains no information from which it could be inferred that the catalysts comprising the modified zeolites of the patent in suit lead to a lower gas production than the known catalysts when used in a hydrocracking process. D1 itself is silent about the amount of gas produced in the hydrocracking process, and the Respondent's allegation that the gas production is likely to be high with the zeolites of D1 is not convincing in the absence of evidence. The date of D1 cannot support this contested allegation. As the patent in suit contains no comparative examples, the alleged

lower gas formation can also not be derived from the examples. Examples 1 to 7 describe the preparation of modified zeolites containing gallium, iron, copper or nickel, having a unit cell size within the claimed range. However, only one catalyst comprising the gallium-containing zeolite was tested in the hydrocracking process of example 8. Although it can be derived from this example that this particular catalyst gives a low gas production and good yields of liquid products boiling at temperatures of  $\leq 300^{\circ}\text{C}$  under the used hydrocracking conditions and with the used feedstock, it cannot be deduced therefrom that such a result would be achieved with the zeolites containing any one of the other metal cations encompassed by claim 1, let alone that a lower gas production than in D1 would be obtained. In the absence of any suggestion in the patent in suit and of any evidence that the modified zeolites containing the various metals defined in claim 1 lead to less gas production and good yields of liquid products when used in a hydrocracking process, the Board is not convinced that the problem defined by the Respondent has actually been solved by the claimed process.

- 4.2 Starting from D1 as the closest prior art, the problem underlying the claimed hydrocracking process can, however, be seen in the provision of a further hydrocracking process. It is proposed to solve this problem by the process as defined in claim 1, which differs from the hydrocracking process of D1 in that the modified zeolite exhibits a unit cell size between 2.421 and 2.440 nm and has been prepared starting from a zeolite Y having an alkali oxide/aluminium oxide ratio of at most 0.05. The Board is satisfied that this problem has actually been solved by the claimed process in view of example 8 of the patent in suit and of the

statement in column 1, lines 34 to 40, that the modified zeolites prepared according to the patent in suit have interesting properties and are of importance in the preparation of hydrocracking catalysts.

- 4.3 As indicated above in connection with the novelty issue, the skilled person carrying out the teaching of D1 would not inevitably arrive at a modified zeolite having a unit cell size falling within the claimed range. However, in the Board's judgement, it is immediately apparent from the considerations in point 3.1 above that the skilled person would have considered Y zeolites having Na<sub>2</sub>O contents and alkali oxide/Al<sub>2</sub>O<sub>3</sub> ratios within the ranges indicated in present claim 1 to be suitable starting materials for the treatment with the polyvalent metal cations specifically disclosed in D1 and subsequent calcination under the conditions of D1, eg those of example 3. Furthermore, according to D6 the unit cell size of zeolite Y varies from 24.87 to 24.516 Å for SiO<sub>2</sub>/Al<sub>2</sub>O<sub>3</sub> molar ratios changing from greater than 3 up to 6 (see column 14, last paragraph) and D1 does not contain any information which would have deterred the skilled person from using a starting zeolite Y having a unit cell size within the middle or lower part of the said range. As regards the amount of polyvalent cation, D1 discloses incorporating Co and Ni in an amount of about 0.1 to 20 wt% based on the elemental metal (see claim 3). The Respondent has not disputed that by following the teaching of D1 for the preparation of the polyvalent metal-containing zeolites and varying the parameters considered above within the disclosed ranges, the skilled person would have obtained stabilised zeolites having unit cell sizes lying within a range which overlaps with the range specified in present claim 1. Furthermore, the stabilised zeolites of D1 are said to be suitable for use in catalyst compositions for hydrocracking operations. In these



circumstances, the Board considers that the choice of those modified zeolites having a unit cell size from 2.421 to 2.440 nm and prepared from starting zeolites with an alkali oxide/ $\text{Al}_2\text{O}_3$  ratio of at most 0.05 as the solution to the problem of providing a further hydrocracking process, constitutes no more than an **arbitrary** choice from the broad class of stabilised zeolites made available by D1. That choice being arbitrary, it lies within the competence of the skilled person and thus does not involve an inventive step. Therefore, the hydrocracking process according to claim 1 does not involve an inventive step, so that the main request must fail.

5. The experimental evidence submitted by the Appellant on 13 July 1998 was intended to prove that example 1 of D8 destroyed the novelty of the subject-matter of claim 1 according to the main request. As the main request must be refused irrespective of the disclosure of D8, it is not necessary to consider the Appellant's objections concerning the lack of novelty with respect to D8. Therefore, the Respondent's procedural requests concerning the inadmissibility of introducing said evidence into the proceeding have become meaningless and need not be considered here.

#### *Auxiliary request*

6. Amended claims 1 to 4 of the auxiliary request meet the requirements of Article 123(2) and (3). Claim 1 is based on a combination of original claims 10, 7, 8 and 1 with additional features of the description as filed. The use of the catalyst for hydrocracking and the hydrocracking conditions are in particular disclosed on page 1, first paragraph, and page 6, lines 4 to 7, of the original description. The unit cell size range, the upper limit of 2 wt% for the sodium oxide content and the alkali oxide/aluminium oxide molar ratio are stated

respectively on page 4, lines 22 to 24; page 2, lines 11 to 12; and page 3, lines 19 to 21, of the original description. The use of a gallium(III) salt is directly and unambiguously derivable from page 2, line 34, page 3, lines 1 to 4, and example 8 of the description as filed. Dependent claims 2 to 4 correspond to the original claims 4 to 6. The scope of protection of the granted claims has clearly been limited.

7. The process of claim 1 is new over the disclosure of D1 or D8 since none of these documents discloses a modified zeolite Y containing gallium or a gallium component. The Board is satisfied that the novelty of the process according to claim 1 is not prejudiced by any one of the other cited documents.
  
8. D1 represents the closest prior art with respect to the process of claim 1. As indicated above in point 4.1 in connection with the problem defined by the Respondent with respect to D1, it cannot be inferred from the patent in suit that the hydrocracking process carried out with the catalyst including the gallium-containing zeolite of example 8 leads to a lower gas production than in D1. However, from the results indicated in example 8, it can be deduced that with the said catalyst a low amount of gas is produced under the used hydrocracking conditions and feedstock. Therefore, the problem underlying the claimed process with respect to D1 can be seen in the provision of a hydrocracking process leading to a low gas production and at the same time to good yields of liquid fractions boiling at temperatures of  $\leq 300^{\circ}\text{C}$ .

The solution proposed in claim 1 to solve this problem differs from the hydrocracking process of D1 in that a modified gallium-containing zeolite Y is used, which exhibits a unit cell size between 2.421 and 2.440 nm and has been prepared starting from a Y zeolite having an alkali oxide/aluminium oxide molar ratio of at most 0.05.

However, the Appellant disputed that the use of the modified zeolite having the claimed unit cell size contributed to the solution of the technical problem and submitted that the low gas production in example 8 of the patent in suit was due to the low temperature of 338°C used in the hydrocracking process. The Respondent did not agree with this submission. The Board observes that not only the hydrocracking temperature has to be considered but also the whole performance of the catalyst. The catalyst including the gallium-containing zeolite with a unit cell size of 2.436 nm leads to a conversion of 70 wt% of material boiling above 300°C at a hydrocracking temperature of 338°C with low gas production and good yields of fractions boiling at temperatures of  $\leq 300^\circ\text{C}$ . In view of these results, the Board has serious doubts that the low gas formation is due only to the low hydrocracking temperature and cannot be attributed to the modified zeolite. In these circumstances and taking into account that the Appellant's allegation was not supported by any evidence, the Board accepts that, in view of example 8 of the patent in suit, it is credible that the said technical problem has actually been solved by the process defined in claim 1.

- 8.1 D1 itself discloses that the polyvalent metal cations incorporated into the zeolite are preferably selected from the bivalent and trivalent cations, in particular Fe, Co, Ni, Mg, Mn and the rare earth metals. The particularly preferred cations are the iron group

cations, especially Co and Ni due to the improvements in stability and activity occasioned by these cations (see column 2, lines 43 to 53). D1 is silent about the amount of gas produced in the hydrocracking process. It contains no information which would suggest to the skilled person that the use of a gallium-containing zeolite having a unit cell size between 2.421 and 2.440 nm in the hydrocracking process might have led to a low gas production with good yields of liquid products boiling at temperature of  $\leq 300^{\circ}\text{C}$ . Therefore, the skilled person would have had no reason to try gallium as trivalent metal cation in order to solve the said problem.

Furthermore, D2 discloses that a stabilised zeolite is obtained by incorporation of zinc cations into a Y zeolite having an alkali metal content below 1 wt% followed by calcination, but that the treatment of zeolite Y with aluminium sulphate in order to incorporate aluminium cations results in a significant loss of activity due to structural damage. The relative crystallinity of the Al/Y-faujasite after calcination is very low (see claim 1; example 1; Table 1; column 7, lines 25 to 40). As pointed out by the Respondent, in view of this teaching the skilled person would not have been encouraged to incorporate gallium (III)-cations into the zeolite Y having a low alkali metal content since he would have considered that gallium might also cause structural damage to the zeolite and thus decrease its activity, taking into account the position of gallium just under aluminium in Group III of the periodic system.

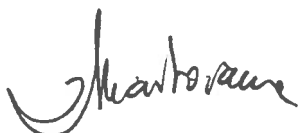
- 8.2 The Appellant did not rely on D7 and D8 in connection with claim 1 of the auxiliary request, nor upon the other documents cited in the course of the opposition proceedings. The Board is satisfied that the disclosure of these documents taken in isolation or in combination with the teaching of D1 and D2 does not hint at the claimed solution.
- 8.3 It follows from the above that the subject-matter of claim 1 of the auxiliary request involves an inventive step and that claim 1 meets the requirements of patentability set out in Article 52(1) EPC.
9. Claim 1 being allowable, the same applies to dependent claims 2 to 4, whose patentability is supported by that of the main claim.

## Order

### For these reasons it is decided that:

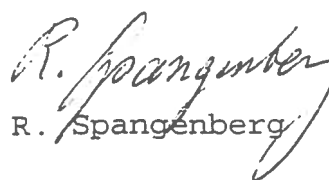
1. The decision under appeal is set aside.
2. The case is remitted to the Opposition Division with the order to maintain the patent with claims 1 to 4 submitted as auxiliary request during the oral proceedings before the Board of appeal and a description to be adapted.

The Registrar:



P. Martorana

The Chairman:



R. Spangenberg

