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Datasheet for the decision of 19 February 2016

Case Number: T 1566/14 - 3.3.06

Application Number: 99962151.9

Publication Number: 1137741

IPC: C10G45/64, B01J29/06

Language of the proceedings: EN

Title of invention:
CATALYTIC DEWAXING PROCESS

Patent Proprietor:
Shell Internationale Research Maatschappij B.V.

Opponent:
CHEVRON USA, Inc.

Headword:
Catalytic dewaxing/SHELL

Relevant legal provisions:
EPC Art. 52(1), 56

Keyword:
Inventive step - obvious combination of features disclosed in the closest prior art document

Decisions cited:

Catchword:

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Case Number: T 1566/14 - 3.3.06

D E C I S I O N
of Technical Board of Appeal 3.3.06
of 19 February 2016

Appellant: (Opponent)	CHEVRON USA, Inc. P.O. Box 6006 San Ramon, California 95583-4289 (US)
Representative:	Brown, David Leslie Haseltine Lake LLP Redcliff Quay 120 Redcliff Street Bristol BS1 6HU (GB)
Respondent: (Patent Proprietor)	Shell Internationale Research Maatschappij B.V. Carel van Bylandtlaan 30 2596 HR Den Haag (NL)
Representative:	Shell Internationale Research Maatschappij B.V. Intellectual Property Division, P.O. Box 302 2501 CH Den Haag (NL)
Decision under appeal:	**Interlocutory decision of the Opposition Division of the European Patent Office posted on 6 May 2014 concerning maintenance of the European Patent No. 1137741 in amended form.**

Composition of the Board:

Chairman	B. Czech
Members:	E. Bendl
	O. Loizou

Summary of Facts and Submissions

I. The present appeal by the opponent lies from the interlocutory decision of the opposition concerning maintenance of European patent No. 1 137 741 in amended form.

II. In the decision under appeal, the opposition division came to the conclusion that the subject-matter of the then pending first auxiliary claim request complied with the requirements of the EPC, and expressly acknowledged *inter alia* novelty and inventive step in the light of the prior art invoked, including documents

D1: US 5 804 058 A,
D10: Kennedy C. R. et al., "Effect of Crystallite Size on the Activity and Poison Resistance of a Shape-Selective Zeolite"; Industrial Engineering Chemical Research 20, 1991, pages 12-18, and
D33: WO 92/01657 A1.

III. Claim 1 held allowable by the opposition division reads as follows:

"1. *Process for the catalytic dewaxing of a hydrocarbon feed comprising waxy molecules by contacting the hydrocarbon feed under catalytic dewaxing conditions with a catalyst composition comprising metallosilicate crystallites, a binder and a hydrogenation component in which the metallosilicate crystallite* [sic] *have a Constraint Index of between 2 and 12 and are chosen from the group consisting of ZSM-5, ZSM-11, ZSM-12, ZSM-22, ZSM-23, ZSM-35, ZSM-38, ZSM-48, ZSM-50, TMA offretite and Clinoptilolite, and which binder is a low acidity refractory oxide binder which binder is essentially free of aluminium, wherein the weight ratio of the*

metallosilicate crystallites and the binder is between 5:95 and 35:65 and the size of the metallosilicate crystallites are [sic] *between 0.05 and 0.2 µm and of which crystallites the number of alumina moieties has been reduced.*"

IV. In its statement of grounds of appeal, the appellant (opponent) argued that the subject-matter of said claim lacked novelty over document D1 or at least did not involve an inventive step taking D1 as the closest prior art. In this connection it referred also to, *inter alia,* documents

D8: Weitkamp J. et al., "Catalytic test reactions for probing the pore width of large and super-large pore molecular sieves"; Catalysis Today, 19, 1994, pages 107-150 (already filed in the opposition proceedings),

D10 and D33.

V. The respondent (patent proprietor) did not reply within the set time limit. However, in a written submission dated 31 March 2015, it defended the patent in the version held allowable by the opposition division and re-filed a copy of the corresponding claims as main request. Moreover, referring to the publication of decision G 3/14 on 24 March 2015, it also filed amended claims as auxiliary request I without, however, commenting on any of the substantive issues raised by the appellant with regard to the pending main request.

Independent claim 1 of this auxiliary request I differs from claim 1 of the main request in that the wording

"*and of which crystallites the number of alumina*

moieties has been reduced"

is replaced by

"*which crystallites have been subjected to a dealumination treatment*".

VI. In a further letter, the appellant considered *inter alia* that auxiliary request I should not be admitted at this late stage into the proceedings, and also requested an order for costs incurred.

VII. The parties were summoned to oral proceedings.

VIII. In its further letter the respondent stated *inter alia* that all arguments and documents presented so far in the opposition and appeal proceedings "are to be considered as part of the submissions". It also relied on and re-filed a copy of the following document (already filed in 2010)

DM: Maesen Th. L. M. et al., "The Shape Selectivity of Paraffin Hydroconversion on TON-, MTT- and AEL Type Sieves"; Journal of Catalysis, 188, 1999, pages 403-412.

IX. The appellant replied by objecting to this letter of the respondent, considering it as an inadmissible attempt to import the entire history of the proceedings and to additionally raise new issues. It maintained its request for cost apportionment under Article 16(1) RPBA.

X. At the oral proceedings held on 19 February 2016, the debate focused first on the issues of novelty and inventive step in the light of D1, with regard claim 1 of the pending main request (claims held allowable by

the opposition division).
The respondent then expressly conceded that, as regards the pending first auxiliary request, the additional amendment made to claim 1 had no bearing on the issue of inventive step in the light of D1 and that, therefore, the same reasoning would apply as regards inventive step over D1.

The appellant also explicitly withdrew its request for apportionment of costs incurred pursuant to Article 16(1) RPBA.

XI. The appellant requested that the decision under appeal be set aside and that the patent be revoked.

The respondent requested that the appeal be dismissed (main request) or, in the alternative, that the patent be maintained in amended form on the basis of the claims according to the first auxiliary request, filed with letter dated 31 March 2015.

XII. The arguments of the **appellant**, as far as relevant to the present decision, can be summarised as follows:

Main request - Novelty - Claim 1

- D1 clearly disclosed a process with all the features of claim 1 of the main request, including the claimed combination of crystallite size and crystallite : binder weight ratio, without a need for any untaught, multiple selection within the total disclosure of this document.

Main request - Inventive step - Claim 1

- D1, in particular example 4 thereof, was the closest state of the art.
- The claimed dewaxing process was diffusion limited

and the skilled person knew, e.g. from D8 or D10, that diffusion limited zeolites became more active with reduced crystallite size.

- No technical effect had been made credible by the respondent, in particular because the examples of the patent in suit did not fall within the ambit of claim 1.
- The problem to be solved consisted merely in providing an alternative dewaxing process.
- The claimed invention was simply a combination of features disclosed in D1 and therefore could be derived from this document without inventive skills, taking into account common general knowledge, if required.

Auxiliary request

- The late filing of this amended claim set was unjustified. The first auxiliary request should thus not be admitted (Articles 12 and 13 RPBA).

The arguments of the **respondent**, as far as relevant to the present decision, can be summarised as follows:

Novelty

- D1 did not disclose a process with all the features of claim 1 in combination, since several choices had to be made within the disclosure of D1 to arrive at a process as claimed.

Inventive step

- D1 was the closest state of the art.
- The problem to be solved consisted in providing a dewaxing process using a more active catalyst and resulting in less gas production and a higher yield, at least the more active catalyst was essential.

- The technical effects attributable to the combination of small size zeolite crystallites with a specific binder ratio could be derived from the examples on file, which showed that said technical problem had been successfully solved.
- The claimed reaction was not necessarily diffusion limited.
- It was not known where, in terms of pore length/ crystallite size, the boundary between diffusion limitation/non-diffusion limitation was to be found for the specific reaction claimed.
- Hence, the claimed process was not obvious in the light of D1.

First auxiliary request

- The filing of this amended claim request was merely a precautionary measure in view of the order of decision G 3/14. The amendment to claim 1 did not imply any difference (compared to claim 1 of the main request) of relevance in the assessment of inventive step over D1.

Reasons for the Decision

Main request - Novelty

1. The appellant's arguments regarding the alleged lack of novelty of the subject-matter of claim 1 over the disclosure of document D1 did not convince the board. For the board, a process with all the features of claim 1 is not directly and unambiguously disclosed in this document. However, since the claimed subject-matter was found to lack an inventive step (see point 2 *et seq.*, *infra*), more details regarding the considerations leading to this conclusion need not be given here.

Differences between the process of claim 1 and the closest prior art process emanate to some extent from the following reasoning.

Main request - Inventive step - Claim 1

2. The invention

The invention concerns a process for the catalytic dewaxing of a hydrocarbon feed (paragraph [0001] of the patent in suit).

3. Closest prior art

3.1 For the board, considering the similarities between the patent in suit and D1 in terms of objectives and features of the processes concerned, D1 is the closest prior art for the assessment of inventive step according to the problem-solution-approach. This was also common ground between the parties.

3.2 D1 discloses a process for catalytic dewaxing of hydrocarbon oils containing waxy molecules (column 1, lines 6 to 8). The process is stated to give high yields, and the catalyst composition, comprising molecular sieve containing crystallites, is stated to exhibit an "*optimum combination of stability, selectivity and activity*" (paragraph bridging columns 2 and 3).

3.3 More particularly, the process described in Example 4 of D1 is the most appropriate starting point: It comprises the dewaxing of a hydrocracked waxy raffinate under dewaxing conditions, using a surface dealuminated silica-bound ZSM-5 zeolite catalyst loaded with platinum. The ratio zeolite : silica binder is 70:30 (at most

35:65 according to claim 1 at issue) and the zeolite crystallite size (between 0.05 and 0.2 mm according claim 1 at issue) is not indicated.

4. Technical problem according to the respondent

At the onset of the oral proceedings, the respondent maintained that in the light of the closest prior art (3.3, *supra*), the technical problem consisted in providing a dewaxing process using a more active catalyst and achieving increased yield whilst producing a lower amount of gas ("*gas make*"); see also paragraph [0004] of the patent in suit.

5. Solution

As the solution to the stated technical problem, the patent in suit in the amended version held allowable by the opposition division proposes the hydrocarbon process according to claim 1 at issue, which is characterised *inter alia* in that (emphasis added) "... *the weight* ***ratio*** *of the* ***metallosilicate crystallites*** *and the* ***binder*** *is* ***between 5:95 and 35:65*** *and the* ***size*** *of the metallo-silicate* ***crystallites*** *are* ***between 0.05 and 0.2 µm*** *...*"

6. Success of the solution

6.1 The board does not accept the argument of the respondent that the examples of the patent in suit demonstrate that the effects mentioned above (combination of improved activity of the selected catalysts, higher yields and reduced gas make) are indeed obtained, as the majority of the examples supposed to prove this falls outside the ambit of claim 1:

6.1.1 Examples 1 and 2 of the patent do not directly and

unambiguously disclose embodiments of the process of claim 1 at issue, as the size of the zeolite crystallites is not given.

In example 3, the zeolite used (SSZ-32) is not one of the possible types listed in claim 1 at issue.

In examples 4 and 5, the particle sizes of the zeolite crystallites are not indicated. Moreover, the catalyst composition comprises a TON zeolite (not listed in claim 1) which was not dealuminated (as required by claim 1).

The zeolite of example 2c was not subjected to dealumination. According to example 2a, the zeolite particle size is 1 - 2 µm, i.e. outside the claimed range.

6.1.2 Thus, only example 2b appears to illustrate a process (dealuminated ZSM-12; silica binder; weight ratio 10:90; crystallite size 0.1 to 0.2 µm) according to claim 1 at issue.

However, example 2b is not fully comparable with example 4 of D1, as the zeolite types used (ZSM-12 and ZSM-5, respectively) are not the same.

6.2 A comparison between the data of examples 2a (not falling under claim 1) and example 2b (in accordance with claim 1) shows the following.

6.2.1 The processes of examples 2a and 2b differ only in terms of the size of the ZSM-12 zeolite crystallites used (ex. 2a: 1-2 µm; ex. 2b: 0.1-0.2 µm). The yield obtained in both cases is identical (91 wt%). What can be derived from these examples is that the reaction temperature is lower with smaller zeolite crystallite size

(ex. 2a: 358°C; ex. 2b: 312°C), but at the expense of the gas production, which increases from 2.9 to 3.6 wt%.

6.2.2 Thus, even a comparison of example 2b with example 2a does not prove the invoked combination of improved activity, increased yield and reduced gas make.

6.3 As already indicated (6.1.2, *supra*, the comparison of example 2b with example 4 of D1 is not meaningful, as they refer to different zeolites (ZSM-12 versus ZSM-5).

6.4 Thus, the board is not convinced that the stated technical problem (point 4, *supra*) is effectively solved by the claimed solution, let alone across the full ambit of claim 1.

7. Reformulation of the technical problem

Considering the above finding, the technical problem in the light of the closest prior art D1/example 4 must be re-formulated in less ambitious terms. As was suggested by the appellant, it can be seen in providing an alternative dewaxing process.

8. Success of the solution

Considering *inter alia* the data of example 2b of the patent in suit, the board is satisfied that this less ambitious problem is effectively solved by the claimed process. This was not in dispute.

9. Obviousness

9.1 It thus remains to be decided whether the claimed solution (see point 5, *supra*) was obvious to the skilled person having regard to the state of the art, i.e.

whether it was obvious to modify the process of D1/ example 4 by decreasing the zeolite to binder ratio and using crystallite with a size within the range according to claim 1 at issue (0.05 to 0.2 µm).

9.2 D1 discloses a wide spectrum of zeolite crystallite sizes suitable for carrying out the dewaxing process described therein. In column 6, lines 16 to 22, a range of from 0.1 to 50 µm is disclosed. 0.1 µm is expressly mentioned as the lower limit of the range providing optimum catalytic activity, and the value of 0.2 µm belongs to an even more preferred range.

9.2.1 D1 also discloses in column 6, lines 35 to 44, zeolite/ binder ratios ranging from 10/90 to 90/10, the value of 20/80 being the lower limit of the preferred range.

9.3 Thus, the only features distinguishing example 4 of D1 from claim 1 at issue can also be found as possible options in the description of D1. In the absence of any demonstrated effect attributable to these distinguishing features, modifying the method of D1/example 4 whilst remaining within the boundaries of the broader teaching of this document, i.e. using a zeolite : binder ratio and a crystallite particle size as defined in claim 1 at issue, is merely one of several solutions equally obvious to a skilled person seeking to solve the problem of providing an alternative dewaxing process.

9.4 Hence, in the board's judgement, the subject-matter of claim 1 does not involve an inventive step (Articles 52(1) and 56 EPC).

9.5 Further line of argument of the respondent

9.5.1 At some point during the oral proceedings, the

respondent also argued that the technical problem actually solved could at least be seen in providing a dewaxing process with reduced reaction temperature, i.e. with improved catalyst activity. For the following reasons, this approach did not convince the board either.

9.5.2 The board accepts that the appellant, referring in particular to D10, convincingly argued in writing (statement of grounds, page 43, penultimate paragraph pointing to D10) and at the oral proceedings that **for diffusion limited reactions** the catalytic activity of zeolite crystallites can be expected to increase with reduced crystallite size. Reference is made in particular to table I, figures I and VII of D10, as well as to the paragraph bridging the columns on page 13 of D10, which reads: "*The observed reaction rates decrease with increasing particle size. Since all crystallites have similar SiO_2/Al_2O_3 ratios, these results suggest a reaction rate limited by diffusion in the crystallites*".

9.5.3 At the oral proceedings, reference was additionally made to a statement in D8 (page 110, last full paragraph) pointing in the same direction and reading: "*... the observed rates of reaction limited by diffusional effects, and hence the observed selectivities, will be dependent under otherwise constant conditions, on the length of the intracrystalline diffusion paths, i.e. the crystallite size of the zeolite catalyst*".

9.5.4 The board accepts that the skilled person gathers from these citations that for diffusion limited reactions increased reaction rates can be expected when using smaller crystallite sizes. The skilled person would therefore conclude that in diffusion limited reactions smaller crystal sizes can be expected to lead to

improved catalyst activity, corresponding to a decreased reaction temperature.

9.5.5 A question of dispute between the parties was whether the dewaxing process according to claim 1 actually involved a diffusion limited reaction. Although the respondent denied this in its generality, it stated repeatedly that the skilled person did not know where the boundary between diffusion limited and non-limited processes was to be found in terms of crystallite particle size. It expressly emphasized that one could not *a priori* assume generally that, for a given medium pore size zeolite, changing from one crystallite size to another would also mean changing from a diffusion limited regime to a non-diffusion limited one. Moreover, effects shown for one given type of zeolite could not be generalised to a broader group of zeolites.

9.5.6 Taking into account these statements, the respondent's reference to document DM (assuming *arguendo* its admissibility and pre-publication; see page 411, right-hand column, first full paragraph), and to D33 (see tables I, II), both allegedly showing that a process according to claim 1 at issue was not diffusion limited, is of little relevance, as these documents both concern specific zeolites and specific reactions under defined conditions.

9.5.7 Hence, even the respondent could not unambiguously and, hence, convincingly establish whether the claimed process is actually diffusion limited, or not. The board understands from the submissions made that even if the claimed process were indeed not diffusion limited for one specific type and particle size of the zeolite, this would not necessarily be the case when using one of the other specific zeolite types listed in claim 1.

Accordingly, although a lower reaction temperature may apparently be achieved using ZSM-12 with a crystallite size within the range according to claim 1 at issue, as in example 2b of the patent, there is no evidence on file convincingly showing that this would also be the case when using any of the other zeolites listed in claim 1.

9.5.8 In the absence of such evidence the board is not convinced that the less ambitious technical problem ultimately formulated by the respondent at the oral proceedings (point 9.5.1, *supra*) is effectively solved across the full breadth of claim 1. Hence, the objective technical problem to be considered can only be the one formulated under point 7, *supra.*

9.5.9 For the sake of completeness, the board also observes that the skilled person apparently knew that it was possible that the reaction was (at least for some zeolites) diffusion limited and that for diffusion limited reactions smaller zeolite crystallite sizes could be expected to increase reaction rate. The board thus holds that it would have been obvious to the person skilled in the art to try implementing the process of example 4 of D1 using zeolites of relatively small crystallite size, in order to achieve lower reaction temperatures, and suitable amounts of binder, thereby arriving at a process falling within the ambit of claim 1.

10. The respondent's main request is thus not allowable.

Auxiliary request I

11. For the board, the above reasoning obviously applies also to claim 1 of auxiliary request I despite its

amended wording. At the oral proceedings, the respondent conceded that the change in wording had no bearing on the assessment of inventive step in the light of D1, the amendment to claim 1 being only supposed to overcome a clarity objection possibly to be expected in the light of decision G 3/14. Therefore, a detailed reasoning need not be given in this respect.

12. Even if auxiliary request I were to be considered admissible (*arguendo*) despite its late filing, claim 1 thereof would thus likewise not be allowable for lack of inventive step (Articles 52(1) and 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:

D. Magliano B. Czech

Decision electronically authenticated