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Datasheet for the decision of 21 February 2024

Case Number: T 0649/22 - 3.3.06

Application Number: 11788621.8

Publication Number: 2531297

IPC: B01J29/89

Language of the proceedings: EN

Title of invention:
PROCESS FOR MAKING TITANIUM-MWW ZEOLITE

Patent Proprietor:
Lyondell Chemical Technology, L.P.

Opponent:
BASF SE

Headword:
Lyondell/Titanium-MWW

Relevant legal provisions:
EPC Art. 100(a), 56

Keyword:
Grounds for opposition - lack of patentability (no)
Inventive step - (yes)

Decisions cited:

Catchword:

Europäisches Patentamt
European Patent Office
Office européen des brevets

Beschwerdekammern

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Case Number: T 0649/22 - 3.3.06

D E C I S I O N
of Technical Board of Appeal 3.3.06
of 21 February 2024

Appellant: (Patent Proprietor)	Lyondell Chemical Technology, L.P. Two Greenville Crossing 4001 Kennett Pike, Suite 220 Greenville, Delaware 19807 (US)
Representative:	LyondellBasell c/o Basell Poliolefine Italia Intellectual Property P.le Donegani 12 44122 Ferrara (IT)
Respondent: (Opponent)	BASF SE 67056 Ludwigshafen (DE)
Representative:	Altmann Stößel Dick Patentanwälte PartG mbB Theodor-Heuss-Anlage 2 68165 Mannheim (DE)
Decision under appeal:	**Decision of the Opposition Division of the European Patent Office posted on 11 January 2022 revoking European patent No. 2531297 pursuant to Article 101(3)(b) EPC.**

Composition of the Board:

Chairman	J.-M. Schwaller
Members:	S. Arrojo
	R. Cramer

Summary of Facts and Submissions

I. An appeal was filed by the patent proprietor against the decision of the opposition division to revoke European patent No. 2 531 297, claim 1 thereof reading as follows:

"1. A process for producing a titanium-MWW zeolite, which comprises:
(a) heating a gel formed from a titanium compound, a silicon source, a boron source, an MWW-templating agent, and water at a temperature in the range of 35°C to 75°C for a period of 8 to 30 hours to form a pre-crystallized gel; and
(b) heating the pre-crystallized gel at a temperature in the range of 160°C to 190°C for a period of 5 or more days to form the titanium-MWW zeolite;
wherein the MWW-templating agent is piperidine or hexamethyleneimine.".

II. In the decision under appeal, the Opposition Division concluded that the subject-matter of claim 1 as granted and of auxiliary request 1 was obvious in view of **D1** (Peng Wu et al., Chemistry Letters 2000, p. 774-775) combined with the teachings of either **D4** (EP 1 731 515) or **D6** (den Ouden et al., Ind. Eng. Chem. Res. 1992, 31, p. 369-373). Auxiliary request 2 was not admitted, because it would have given rise to further issues under Article 123(3) EPC.

III. In its statement of grounds of appeal filed on 11 May 2022, the appellant requested that the above decision be set aside and the patent be maintained as granted (main request) or, as an auxiliary measure, that the patent be maintained on the basis of the claims

according to one of auxiliary requests 1 or 2 filed therewith.

IV. In its reply, the opponent and respondent requested that the appeal be dismissed and the decision to revoke the patent be upheld, arguing that none of the requests met the requirements of inventive step in view of D1 combined with D4 or D6. Auxiliary request 2 should furthermore not be admitted and did also not comply with the requirements of Article 123(3) EPC.

V. In its preliminary opinion the board held the main request to be not obvious in view of D1 combined with D4 or D6.

VI. In a submission dated 15 February 2024, the respondent withdrew its request for oral proceedings and announced that it would not attend the scheduled oral proceedings.

VII. In view of the preliminary opinion and the withdrawal by the respondent of its request for oral proceedings, the Board cancelled the oral proceedings and is now in a position to issue a written decision.

Reasons for the Decision

1. Main request - Inventive Step

The Board has concluded that the opposition ground under Article 100(a) EPC in combination with Article 56 EPC does not prejudice the maintenance of the patent as granted for the following reasons:

1.1 Both parties considered D1 to be the closest prior art, as this document (page 774, 1st par. of the right col.)

discloses a process for the synthesis of a Ti-MWW precursor with a templating agent containing piperidine. The crystallisation process is carried out with a first step of stirring at 403 K (130°C) for 1 day, then at 423 K (150°C) for 1 day and finally at 443 K (170°C) for 5 days. The thus obtained solid product is finally dried at 323 K (50°C) for 1 day.

Thus, as agreed by both parties, the subject matter of claim 1 differs therefrom in providing a first step of heating the gel to a temperature in the range of 35°C to 75°C for a period of 8 to 30 hours (step (a) in claim 1).

1.2 Problem solved by the invention

1.2.1 According to the opposed patent (see par. [0005]), the object of the invention is to provide a process for producing titanium MWW zeolites which form high activity catalysts more efficiently. The patent includes several examples and comparative examples which indicate (see Tables 1 and 2 and par. [0042]) that those processes including a heating step (a) according to claim 1 form crystalline titanium MWW zeolite in less time and/or more effectively than processes which do not include this step.

1.2.2 The respondent argued that the patent provided no evidence of any technical effect associated with step (a) of claim 1. The catalytic activity and the nature of the products shown in Tables 1 and 2 of the patent did not relate to the intermediate product obtained by the process according to claim 1, but to the material obtained after subjecting that intermediate product to further acid treatment and calcination steps. As claim

1 did not include these steps, the results in these tables could not be taken into account.

Furthermore, the respondent referred to the experimental reports E1 to E3 submitted during first instance proceedings, and argued that the reworking of examples 1B (see E1), 1M (see E2) and 1H, 1K and 1L (see E3) led to the conclusion (in view of E1 and E2) that the processes in the comparative examples 1B and 1M also produced a crystalline structure, so that the addition of step (a) could not be associated with any effect. The same conclusion was drawn from E3, as the three examples 1H, 1K and 1L resulted in a similar degree of crystallinity despite the fact that 1K did not include step (a). Therefore, no technical effect could be attributed to step (a) and the problem solved by the invention was simply to provide an alternative process for the preparation of a zeolite intermediate.

1.2.3 The Board disagrees with these arguments because, at the very least, the examples in the patent show that the process according to the invention is more efficient than the processes without step (a), either because it takes less time to obtain a suitable product, or because a more suitable product can be obtained with a similar treatment time. From this point of view, the values for crystallinity and catalytic activity in the tables can be seen as an indicator of the suitability of the intermediate product. In other words, the invention is not based on obtaining better catalysts, but on producing titanium MWW zeolites more efficiently, which seems to correspond to the objectives set out in par. [0005] of the patent.

As pointed out by the appellant, by comparing example 1C according to the invention with comparative example

1A (both having a Si/ti molar ratio of 39), it is apparent that the process according to the invention is more efficient as it requires significantly less time to produce a suitable zeolite. Example 1F according to the invention achieves a higher crystallinity than comparative example 1B with the same treatment time, again indicating that the process according to the invention is more efficient. A similar conclusion can be drawn from Table 2, where examples 1K and 1L according to the invention achieve a higher degree of crystallinity in a shorter time than the comparative example 1G, so that in these cases the process according to the invention leads to better results in a shorter time, which again demonstrates the higher efficiency of the process according to the invention.

The Board does not see how the respondent's reworking of the examples in reports E1 to E3 would invalidate the above conclusions, since the respondent admitted that the process in report E1 had a Si/Ti lower than that of comparative example 1B in the patent, so it was not a reworking thereof. Nor can it be concluded that a crystalline structure would be obtained in comparative example 1B (i.e. that the results shown in Table 1 are incorrect), simply because a crystalline product is obtained within a similar time both with a lower Si/Ti (see E1) and with a higher Si/Ti (see D1), since the relationship between the required treatment time and Si/Ti seems too complex to assume that an interpolation can be applied (for example, the shortest time to crystallinity according to Tables 1 and 2 of the patent is observed for the intermediate Si/Ti value of 34). In any event, even if it were accepted that comparative examples 1B and 1M lead to a crystalline structure, the examples in the patent would still show that the process of the invention produces a crystalline

structure in a shorter treatment time and at comparatively lower temperatures (see examples 1K or 1L).

As regards report E3, the Board notes that, contrary to the respondent's arguments, all the experiments reproduced therein (1H, 1K and 1L) appear to relate to processes according to the invention. In particular, experiments 1H, 1K and 1L are presented in Table 2 of the patent as processes according to the invention, since they all include a step (a) of exposing the gel to a temperature of from 35°C to 75°C for a period of 8 to 30 hours (including example 1K, which the respondent presents as a process not according to the invention, despite the fact that it includes a first step of heating the gel to a temperature of 60°C for a period of 18 hours). The conclusion that all three processes lead to a similar crystalline structure is thus entirely consistent with the results in Table 2 of the patent.

All in all, the Board concludes that it has been sufficiently proven that the inclusion of a step (a) according to claim 1 leads to a more efficient process. The invention is therefore considered to successfully solve the problem of providing a process for producing a titanium-MWW zeolite more efficiently.

1.3 Non-obviousness of the solution

1.3.1 The respondent argued that the solution proposed in claim 1 was obvious in view of the teachings in D4 or in D6. In particular, D4 disclosed (see par. [0013]) that in processes for the production of titanium-MWW zeolites, the temperature was typically raised at a rate of 0.01 to 2 K/min. D6 similarly indicated that

heating rates of 0.5 K/min or less were common in the field. By simply operating within these known ranges for the heating rates, the process in D1 would be at a temperature of 35 to 75°C for a period from 20 minutes to 66.6 hours. Therefore, by selecting a heating rate within the lower portion of these known ranges, the resulting process would effectively include a step falling within step (a) of claim 1. The subject-matter of claim 1 was therefore not inventive in view of the combination of D1 with the teachings of D4 or D6.

1.3.2 The Board does not agree with the above reasoning as it is based on the assumption that the only problem solved by the invention is to provide an alternative process. Since the problem solved is to provide a process for producing titanium-MWW zeolite more efficiently, the relevant question is whether the skilled person would select low heating rates for the purpose of improving the efficiency of the process. Neither D4 nor D6 contain any indication that selecting lower heating rates would improve the efficiency of the process. On the contrary, as the respondent himself argued, D6 teaches (see page 371, left column) that the observed nucleation was similar for all simulated heating rates, implying that choosing a lower heating rate would simply lead to an unnecessarily longer and therefore less efficient process.

The Board therefore sees no incentive for the skilled person to consider working at low heating rates in view of D4 or D6, let alone to consider a heating rate equal to or less than 0.083 K/min, which is the maximum heating rate that would result in a period of 8 hours or more within the temperature range of 35 to 75°C as defined in claim 1 at issue.

1.3.3 The subject-matter of claim 1 is thus not rendered obvious by the disclosure of D1 combined with the teachings of D4 or D6. The requirements of inventive step within the meaning of Article 56 EPC are therefore met.

2. Since the sole ground for opposition invoked by the respondent does not prejudice the maintenance of the patent as granted, the appeal of the proprietor succeeds.

Order

For these reasons it is decided that:

1. The decision of the opposition division is set aside.

2. The patent is to be maintained as granted.

The Registrar: The Chairman:

A. Pinna J.-M. Schwaller

Decision electronically authenticated