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**Datasheet for the decision
of 15 December 2017**

Case Number: T 1463/13 - 3.3.10

Application Number: 07841389.5

Publication Number: 2064168

IPC: C07C2/66

Language of the proceedings: EN

Title of invention:

PROCESSES FOR THE REDUCTION OF ALKYLATION CATALYST
DEACTIVATION UTILIZING LOW SILICA TO ALUMINA RATION CATALYST

Applicant:

Fina Technology, Inc.

Headword:

Relevant legal provisions:

EPC Art. 56

Keyword:

Main Request and Auxiliary Request - Inventive step (no) -
obvious alternative

Decisions cited:

Catchword:



Beschwerdekammern
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Case Number: T 1463/13 - 3.3.10

D E C I S I O N
of Technical Board of Appeal 3.3.10
of 15 December 2017

Appellant: Fina Technology, Inc.
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Decision under appeal: Decision of the Examining Division of the
European Patent Office posted on 11 February
2013 refusing European patent application No.
07841389.5 pursuant to Article 97(2) EPC.

Composition of the Board:

Chairman P. Gryczka
Members: C. Komenda
C. Schmidt

Summary of Facts and Submissions

- I. The appeal lies from the decision of the Examining Division to reject the European patent application Nr. 07 841 389.5 relating to "processes for the reduction of alkylation catalyst deactivation utilizing low silica to alumina ratio catalyst".
- II. In its reasoning the examining division referred *inter alia* to the documents

(3) WO 02/14240 A1 and
(6) US 2004/0068151 A1.

The examining division found that the subject-matter of claim 1 of the then pending main request did not comply with the requirements of Article 84 EPC, and that the subject-matter of the then pending first and second auxiliary requests did not involve an inventive step when starting from document (3) as the closest prior art.

- III. Together with its statement of the grounds for appeal dated 6 June 2013 the appellant filed a new main request corresponding to the first auxiliary request on which the decision under appeal was based, and a new auxiliary request, corresponding to the third auxiliary request, which has been withdrawn by the appellant during the proceedings before the Examining Division. The wording of independent claim 1 of the new main request was as follows:

*"1. An alkylation process comprising:
a preliminary alkylation step adapted to receive an
input stream and contact the input stream with a
preliminary alkylation catalyst comprising a*

zeolite catalyst comprising an SiO_2/Al_2O_3 ratio of less than 50 disposed therein to form a first output stream,
wherein the input stream comprises an aromatic hydrocarbon;
and a first alkylation step adapted to receive the first output stream and contact the first output stream with a first alkylation catalyst disposed therein and an alkylating agent to form a second output stream
and wherein the first alkylation catalyst comprises a cerium promoted zeolite beta catalyst,
the aromatic hydrocarbon comprises benzene,
the alkylating agent comprises ethylene and the second output stream comprises ethylbenzene,
the preliminary alkylation step is operated at a temperature of from 20°C to 270°C and a pressure of from 675 kPa to 8300 kPa."

A further independent claim 2 related to a similar alkylation process characterized by alternative alkylation parameters.

The wording of independent claim 1 of the auxiliary request was based on the wording of claim 1 of the main request, wherein the claimed process was further restricted to a " *SiO_2/Al_2O_3 ratio of 5 to 25*" and the preliminary catalyst was characterized as "*comprising a zeolite Y or zeolite beta catalyst*"

IV. The appellant argued that the decision under appeal was wrong in finding that the claimed subject-matter did not involve an inventive step. Starting from document (3) as the closest state of the art the problem was to provide a further successfully performing alkylation process. In order to arrive at the claimed process the

skilled person would have had to make various specific selections within the disclosure of document (3) itself. Further, the prior art document (6), which was also referred to by the examining division, disclosed alkylation processes which were run under significantly different reaction conditions. Therefore, a skilled person would not have seriously considered to apply the process conditions or the catalysts disclosed in document (6) to the alkylation process of document (3). Consequently, he would not have arrived at the claimed process, because he would not have combined the teachings of documents (3) and (6). The same argumentation applied to the subject-matter of claim 1 according to the auxiliary request, which required further selections to be made within the disclosure of the document (3).

- V. The appellant requested that the decision under appeal be set aside and that a patent be granted on the basis of the main request, or, alternatively, on the basis of the auxiliary request, both requests submitted with letter dated 6 June 2013.
- VI. At the end of the oral proceedings held before the Board the decision was announced.

Reasons for the Decision

1. The appeal is admissible.
2. *Amendments and Novelty (Articles 123(2) and 54 EPC)*

The new main request and the auxiliary request correspond to the first and third auxiliary requests, respectively, as filed during the examination

procedure. The examining division found that the claims according to these requests fulfilled the requirements of Articles 123(2) and 54 EPC. In view of the negative outcome on the question of inventive step (see below) a decision of the board on these issues appears superfluous.

Main request

3. *Inventive step (Article 56 EPC)*

3.1 Claim 1 of the main request relates to a process for the alkylation of benzene to form ethylbenzene, wherein in a separate step the benzene feedstock is purified prior to the alkylation with ethylene. A similar process is already described in document (3), which in agreement with the appellant is regarded as representing the closest state of the art.

3.2 Document (3) discloses a process for the alkylation of an aromatic feedstock, such as benzene, with an olefin such as ethylene, wherein in a first step the benzene is treated with a molecular sieve to remove impurities, followed by an alkylation step, wherein the purified benzene is alkylated with ethylene in the presence of zeolite beta as an alkylation catalyst (claims 10, 11 and 12). The removal of impurities is carried out by a treatment of the benzene feedstock with a molecular sieve at a temperature of 20 to 125 °C (claims 1 and 7) and at a preferred pressure of 2860 to 5600 kPa (page 11, line 8). The suitable molecular sieves have a silica to alumina ratio of less than 100, e.g. from 20 to 50 (claim 6; page 8, lines 1 to 3) and the list of suitable molecular sieves contains zeolite Y and zeolite beta (claim 3). The alkylation reaction of benzene with ethylene is carried out at temperatures

between 300°F (150°C) and 600°F (316°C) in the presence of an alkylation catalyst, such as zeolite beta (page 11, lines 4 to 6; page 10, lines 26 to 29).

3.3 According to the appellant the problem to be solved when starting from document (3) as closest prior art was to provide a successfully running alkylation process. The appellant did not contest that the process disclosed in document (3) also constitutes a successfully running alkylation process. Therefore, the objective technical problem when starting from document (3) can be formulated as to provide an alternative alkylation process.

3.4 As a solution to this problem the application in suit proposes the process according to claim 1 according to the main request, which is characterized in that the alkylation step is carried out in the presence of a cerium promoted zeolite beta catalyst instead of the zeolite beta catalyst as used in the closest prior art.

3.5 The board has no doubts that the alkylation process runs successfully with a cerium promoted zeolite beta catalyst. Therefore, the board accepts that the problem as stated in the preceding paragraph is successfully solved.

3.6 It remains to be decided, whether the use of a cerium promoted zeolite beta catalyst instead of the zeolite beta catalyst used in document (3) was obvious from the prior art.

3.7 Document (6) discloses a process for the preparation of ethylbenzene, wherein a benzene feedstock is alkylated with ethylene in the presence of a cerium promoted zeolite beta catalyst. A skilled person looking for an

alternative alkylation process would, therefore, have also considered to use as zeolite beta catalyst the specific cerium promoted zeolite beta catalyst disclosed in document (6) and would have arrived at the process as claimed in claim 1 without having to exercise any inventive skill.

- 3.7.1 The appellant brought forward that it was not obvious for a skilled person to make a number of specific selections within the disclosure of document (3) and further to select a specific catalyst from document (6) in order to arrive at the claimed process.
- 3.7.2 However, it has to be stated that the skilled person, when looking for an alternative process would have considered to modify specific embodiments disclosed in document (3) with other technical features disclosed in this document, as well as to look for further alternative technical embodiments that were taught in other prior art documents within the same technical field, such as document (6). The mere number of individual selections cannot in itself justify an inventive step, since the selections are not associated with any particular technical effect that could justify an ambitious technical problem other than to provide an alternative.
- 3.7.3 The appellant brought forward that the process conditions in document (6) were significantly different from those in document (3). In particular the pressure and the temperature in document (6) were selected such that the benzene was in a supercritical state during the alkylation step. Therefore, a skilled person would not have considered to use the cerium promoted zeolite beta catalyst under the process conditions used in document (3).

- 3.7.4 However, it has to be stated that when looking into document (6) the skilled person was not deterred from using the cerium promoted zeolite beta catalyst for the alkylation in liquid phase instead of the supercritical phase. The process conditions used in the closest prior art document (3) disclose that the alkylation step is conducted at temperatures ranging up to 316°C (see paragraph 3.2 *supra*), which overlaps with the temperature range of 300°C to 350°C indicated in paragraph [0025] of document (6). Therefore, the skilled person would not have been deterred from using the cerium promoted zeolite beta catalyst of document (6) in the alkylation step, but would have at least tried to use the cerium promoted zeolite beta catalyst under the alkylation conditions taught in document (3).
- 3.8 Therefore, the board concludes that the subject-matter of claim 1 according to the main request does not involve an inventive step (Article 56 EPC).
4. Since the subject-matter of claim 1 was found not to involve an inventive step the board sees no need to further discuss the subject-matter of independent claim 2 in this regard.

Auxiliary request

5. The subject-matter of claim 1 according to the auxiliary request is based on the wording of claim 1 according to the main request and differs therefrom only in that it defined a narrower range for the " SiO_2/Al_2O_3 ratio of 5 to 25" and specifies the preliminary catalyst as "*comprising a zeolite Y or zeolite beta catalyst*" (see paragraph III *supra*).

Since both features are already disclosed in the closest prior art document (3) (see paragraph 3.2 *supra*), they cannot contribute to the solution of the technical problem. Therefore, the arguments and conclusions as given for claim 1 of the main request also apply to the subject-matter of claim 1 of the auxiliary request.

Consequently, the subject-matter claimed in the auxiliary request does also not involve an inventive step.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:



D. Magliano

P. Gryczka

Decision electronically authenticated