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# Datasheet for the decision of 13 October 2011

**Case Number:** T 1242/09 - 3.3.06

**Application Number:** 00978681.5

**Publication Number:** 1319055

**IPC:** C10G 3/00

**Language of the proceedings:** EN

**Title of invention:**
Method for converting oxygenates to olefins

**Patentee:**
ExxonMobil Chemical Patents Inc.

**Opponent:**
UOP LLC

**Headword:**
Conversion of oxygenates to olefins/EXXONMOBIL

**Relevant legal provisions:**
-

**Relevant legal provisions (EPC 1973):**
EPC Art. 83, 54(1)(2), 56

**Keyword:**
"Sufficiency of disclosure - main request (no)"
"Lack of inventive step - first and second auxiliary request (yes)"

**Decisions cited:**
-

**Catchword:**
-

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**Case Number:** T 1242/09 **-** 3.3.06

# D E C I S I O N
**of the Technical Board of Appeal 3.3.06**
**of 13 October 2011**

**Appellant**: (Applicant)
ExxonMobil Chemical Patents Inc.
5200 Bayway Drive
Baytown, TX 77520-5200 (US)

**Representative**:
UEXKÜLL & STOLBERG
Patentanwälte
Beselerstrasse 4
D-22607 Hamburg (DE)

**Appellant**: (Opponent)
UOP LLC
P.O. Box 5017
25 East Algonquin Road
Des Plaines Illinois 60017-5017 (US)

**Representative**:
Dossmann, Gérard
Casalonga & Partners
Bayerstraße 71-73
D-80335 München (DE)

**Decision under appeal:** **Interlocutory decision of the Opposition Division of the European Patent Office posted 27 March 2009 concerning maintenance of European patent No. 1319055 in amended form.**

**Composition of the Board:**

**Chairman:** L. Li Voti
**Members:** E. Bendl
J. Geschwind

## Summary of Facts and Submissions

I. The appeals are from the decision of the Opposition Division to maintain the European patent 1 319 055 in amended form.

II. In opposition procedure the Opponent raised inter alia objections with regard to sufficiency of disclosure, lack of novelty and lack of inventive step and cited among other documents

D1 = US-A-6 023 005

D9 = Conversion of Methanol to Lower Olefins. Kinetic Modeling, Reactor Simulation, and Selection, A.N.R. Bos et al., Ind. Eng. Chem. Res. 34, 3808-3816, 1995.

III. The only independent claim of the main request (set A) on which the Opposition Division decided read as follows:

"1. A method for converting a feed including an oxygenate to a product including a light olefin, said method comprising:

providing a feed including an oxygenate; and
contacting said feed in a reaction zone of a reactor apparatus with a catalyst including a non-zeolitic molecular sieve, said contacting taking place under conditions effective to convert said oxygenate to a product including a light olefin, said conditions including a gas superficial velocity of at least one meter per second at at least one point in said reaction zone and

recirculating a first portion of said catalyst exiting the reactor to recontact said feed,
the temperature differential in the reaction zone being maintained at less than 100°C."

IV. The Opposition Division came inter alia to the conclusion that the invention according to the main request was sufficiently disclosed, but lacked novelty vis-à-vis document D1. The patent was maintained on the basis of one of the then pending auxiliary requests.

V. The Appellant/Proprietor, thereafter referred to as Proprietor, filed an appeal against this decision, maintained set A as its **main request** and filed several auxiliary requests, which were afterwards partly withdrawn. The only auxiliary requests remaining are sets I and O, referred to in the present decision as the first and second auxiliary request, respectively.

VI. Claim 1 of the **first auxiliary request** differs from Claim 1 of the main request in the replacement of the term "of at least one meter per second" by "of greater than four meters per second" and of the text "the temperature differential in the reaction zone being maintained at less than 100°C" by "said portion of recirculating catalyst being used to control the temperature differential in the reaction zone by absorbing a portion of the heat generated by converting said feed including an oxygenate to said product including a light olefin" at the end of the claim.

Claim 1 of the **second auxiliary request** contains the feature "at any point" instead of "at at least one

point", compared to Claim 1 of the first auxiliary request.

VII. Also the Appellant/Opponent, thereafter referred to as Opponent, filed an appeal against the decision of the Opposition Division and objected inter alia that the requests on file would not meet the requirements of Articles 123(2), 83, 84, 54 and 56 EPC and that the two auxiliary requests should not be admitted.

VIII. The main arguments of the **Opponent** were as follows:

*Main request*

Article 83 EPC 1973

– For obtaining the temperature differential mentioned in Claim 1, inlet and outlet temperatures of the reaction zone have to be determined. Details how to do this are only given for the inlet. Therefore, the invention is not sufficiently disclosed.

*First auxiliary request*

Admissibility

– No reasons are given by the Proprietor why the amendments overcome the objections raised in the decision of the Opposition Division. Therefore, the set of claims should not be admitted.

Article 54(1),(2) EPC 1973

– According to the calculations presented by the Opponent in opposition procedure gas superficial velocities of 3,75 m/s were achieved in Example 1 of D1. The velocity being dependent on parameters like the diameter of the reactor, the Opponent

concluded that Example 1 of D1 discloses gas superficial velocities of greater than 4 m/s at (at least) one point of the reaction zone.

– Furthermore reference was made to the high velocity fluidized bed reactor (riser reactor) mentioned in D1 (column 5, lines 41-43 and 55-56), which use gas velocities above 2 m/s. Thus, the claimed subject-matter is not novel.

Article 56 EPC 1973

– The claimed subject-matter is rendered obvious by the teaching of D1, because of the high gas velocities mentioned above. The step of using the catalyst to remove heat is disclosed in column 6, lines 7-14. Furthermore, it is known from D9, page 3813, left-hand column, last full paragraph, that riser reactors use gas velocities as high as 10 m/s.

*Second auxiliary request*

Admissibility

– The Opponent objected that the Proprietor did not indicate why the amendments are suitable to overcome the objections raised in the decision of the Opposition Division. The set of claims should therefore not be admitted.

Article 54(1),(2) EPC 1973

– As mentioned for the first auxiliary request, a gas superficial velocity of greater than four meters is disclosed in D1. Given the fact that even higher velocities are commonly applied (see D9, page 3813, left-hand column, last full

paragraph), it can be concluded that at least 4 m/s are achieved at any point in the reaction zone. The claimed subject- matter is therefore not novel.

Article 56 EPC 1973

– D1 and D9 point towards the use of high gas superficial velocities as well as the step of cooling the catalyst feed in order to remove the heat of reaction; no unexpected technical effect has been proven in the patent-in-suit. Therefore, the claimed subject-matter is not inventive.

The main arguments of the **Proprietor** were as follows:

*Main request*

Article 83 EPC 1973

– Details about the calculation of the inlet temperature are given in the description and the examples. The outlet temperature can either be measured or calculated; the person skilled in the art knows how to measure a temperature. Therefore, the claimed subject-matter is sufficiently disclosed.

*First auxiliary request*

Admissibility

– Novelty and inventive step of the first auxiliary request were discussed in detail in the letter of 03 August 2009. Thus, the Opponent's objection has no basis.

Article 54(1),(2) EPC 1973

– The Proprietor pointed out that gas superficial velocities of above 4 m/s have not been described in the cited prior art. Opponent's arguments are only based on allegations; the claimed subject-matter is therefore novel.

Article 56 EPC 1973

– Even a combination of the teaching of D1 with D9 would not lead to the claimed subject-matter, since the control of the temperature differential by absorbing a portion of the heat generated has not been described in those documents. Consequently, the claimed subject-matter is not derivable from prior art disclosures.

*Second auxiliary request*

Admissibility

– The second auxiliary request is a further restriction of the first auxiliary request and serves to overcome the objections raised by the Opposition Division in its decision. The set of claims should therefore be admitted in the proceedings.

Article 54(1),(2) EPC 1973

– D1 does not disclose a gas superficial velocity of at least 4 m/s. Therefore, novelty is given.

Article 56 EPC 1973

– Even the combination of D1 with D9 would not lead to the claimed subject-matter. No recycling of the catalyst is disclosed in D9. Therefore, the

claimed subject-matter is not derivable from prior art.

IX. The Opponent requested that the decision under appeal be set aside and that the European patent no. 1 319 055 be revoked.

The Proprietor requested that the decision under appeal be set aside and that the patent be maintained in amended form on the basis of the main request (set A), filed with letter of 03 August 2009 or alternatively on the basis of the first auxiliary request (set I), filed on 03 August 2009 or the second auxiliary request (set O), filed on 19 February 2010.

## Reasons for the Decision

1. **Main request**

1.1 *Articles 84,54(1),(2),56 EPC 1973*

The Opponent filed objections based on Articles 54(1),(2) and 56 EPC 1973 with regard to the main request. In addition the introduction of the term "temperature differential" was regarded by the Opponent to be unclear. However, even when taking the Proprietor's position, that the objected term is clear, the claimed invention as defined in the main request is not sufficiently disclosed, as explained in detail hereinafter. Thus, a discussion of the remaining objections is not considered to be necessary.

1.2 *Article 83 EPC 1973*

1.2.1 The Board considers that the invention as defined by the main request is not sufficiently disclosed for the following reasons:

The patent-in-suit describes in detail how to calculate the temperature of the incoming streams; in the example also the temperature in the outlet zone is calculated. In contrast thereto no teaching could be found how to **measure** the temperatures of the different phases, how to take the heat loss into consideration in case of a **non-adiabatic reactor,** which is not explicitly excluded from the wording of the claim or the description, and how to combine the data obtained to a final result.

Thus, the patent-in-suit teaches to determine the temperatures by calculation only. This is even confirmed by the passage in paragraph [0021], lines 14/14: "in the calculation of the temperature of the inlet zone or **of any other part of the reactor**" (emphasis added).

1.2.2 However, when calculating the temperatures it has to be born in mind that a series of assumptions has to be made according to the teaching of the patent-in-suit.

The **inlet** temperature is calculated as is, for instance, defined in the said paragraph [0021]: "Any sensible heat effects of the liquid feed itself are ignored in the calculation of the temperature of the inlet zone or of any other part of the reactor, and only the heat of vaporization is considered once it enters the reactor, in addition to the sensible heat

impacts from the vapors produced from the liquid feed. The assumption is made that a negligible conversion of oxygenate occurs and hence, negligible heat of reaction at the inlet zone is generated, and conversion and heat of reaction only occur to any significant extent in the reactor when the oxygenate has become a vapor".

For the **outlet** temperature such details are not given, apart from the sensible heat effects mentioned above and the assumption that under identical pressure conditions 100% of the methanol is consumed (page 9, lines 33/34). In particular no details are given for a non-adiabatic reactor; the example in the description refers in fact to adiabatic conditions only.

1.2.3 Since no details how to calculate the outlet temperature are given, the temperature differential of a non-adiabatic reactor cannot be determined. Therefore, the invention described in Claim 1 of the main request is not disclosed in a manner sufficiently clear and complete for it to be carried out by a person skilled in the art.

2. **First auxiliary request**

2.1 *Admissibility*

2.1.1 The Board cannot share the Opponent's view that the Proprietor did not give reasons why the first auxiliary request overcomes the objections raised by the Opposition Division. The decision was based on lack of novelty and lack of inventive step. In the letter of 03 August 2009, on pages 14-19, the Proprietor gave a

detailed reasoning with regard to these requirements in respect to the first auxiliary request (set I).

2.1.2 Thus, the first auxiliary request is admitted into the proceedings.

2.2 *Articles 123(2),83,84 EPC 1973*

The Opponent raised objections with regard to Articles 123(2), 83 and 84 EPC 1973. For example, the Opponent objected, that the method of Claim 1 would allegedly only work for an adiabatic reactor, as stated by the Proprietor in his letter of 04 August 2009, whereas Claim 1 is not limited to the use of an adiabatic reactor.

Even when taking the Proprietor's view that a contradiction between the wording of Claim 1 and Proprietor's statement does not exist and that the requirement of clarity is therefore met, the claimed subject-matter is not considered to involve an inventive step for the reasons given below. Therefore, the Board considers that a discussion of these aspects is not necessary.

2.3 *Article 54(1),(2) EPC 1973*

2.3.1 The Board cannot share the Opponent's point of view that gas velocities of greater than 2 m/s, respectively of 3,75 m/s, disclosed in D1 in combination with varying reactor diameters implicitly result in gas superficial velocities of above 4 m/s. Even if Opponent's calculation is assumed to be correct, no proof is given in D1 that the diameter of the reactor

at at least one point is such, that a gas superficial velocity of greater than 4 m/s is achieved.

2.3.2 Therefore, no direct and unambiguous disclosure of this feature can be found in D1 and the Claim 1 of the first auxiliary request meets the requirement of novelty.

2.4 *Article 56 EPC 1973*

2.4.1 According to the problem and solution approach, which is used by the Boards of Appeal of the EPO in order to decide on the question of inventive step, it has to be determined which technical problem the object of a patent objectively solves vis-à-vis the closest prior art document. It also has to be determined whether or not the solution proposed to overcome this problem is obvious in the light of the available prior art disclosures.

The patent-in-suit aims at increasing selectivity and yield of the conversion of oxygenates to olefins (paragraph [0016], lines 26,31).

The document cited by both parties as the closest state of the art, D1, has the same goals (column 2, lines 30,55). Therefore the Board agrees with the parties that D1 is a suitable starting point for examining inventive step.

2.4.2 Since the goals as defined by the present invention have already been achieved by the method of D1 and no further effect has been proven, the objective problem of the patent-in-suit vis-à-vis the closest prior art

can only be the provision of an alternative process to the one of D1.

2.4.3 As the solution to this problem the method of Claim 1 of the first auxiliary request was presented.

2.4.4 The Opponent did not dispute that the provision of an alternative process has been solved over the entire range claimed. The Board shares this opinion.

2.4.5 The question to clarify is, whether the claimed subject-matter was obvious from the teaching of D1, optionally in combination with D9.

The first distinguishing features of present Claim 1 compared to D1 is, as described above, that the example of D1 does not report on a gas superficial velocity of greater than 4 m/s at at least one point in the reaction zone. However, the passages in column 5, lines 42-45 and 55-56 teach implicitly, that gas velocities of **at least 2 m/s** are to be used for the high velocity fluidized bed reactor, also referred to as riser reactor.

It is generally known, that fluidized bed reactors/riser reactors may be operated at gas velocities higher than 2 m/s. Such a teaching is for instance given in D9, which also relates to commercial-scale methanol-to-olefins processes using non-zeolite molecular sieve catalysts (D9, page 3808: summary and left-hand column, third paragraph), where circulating fast fluidized-bed reactors are operated at **3 m/s** (page 3813, first paragraph of chapter 4.5.1 and page 3815, left-hand column, last full paragraph of

chapter 4.5.1). Riser reactors can even be operated at **10 m/s** (page 3813, left-hand column, last full paragraph). Thus, D1 as well as D9 teach, that gas velocities well above 2 m/s are used for processes as presently claimed.

The second characteristic which is not expressis verbis disclosed in D1 is the feature "said portion of recirculating catalyst being used to control the temperature differential in the reaction zone by absorbing a portion of the heat generated by converting said feed including an oxygenate to said product including a light olefin".

The passage in column 6, lines 7-15 of D1 shows that the heat created by the exothermic reaction has to be removed by "any suitable means". Cooling the catalyst as such or alternatively cooling the feed of catalyst to the reactor are only two of the options cited in this disclosure. Thus, D1 hints towards lowering the temperature of the catalyst in order to remove heat from the conversion of an oxygenate to a light olefin. Such a removal of heat is also achieved by the feature in question of the first auxiliary request.

Therefore, in the Board's view, the temperature differential in the reaction zone is necessarily also controlled. No evidence to the contrary was presented by the Proprietor.

Therefore, when starting from document D1, the combination with document D9 leads to the claimed subject-matter and the requirement of Article 56 EPC 1973 is not met.

## 3. **Second auxiliary request**

### 3.1 Admissibility

3.1.1 The Board cannot share the Opponent's point of view that the Proprietor did not give any reasons why the second auxiliary request was filed. As explained in chapter 2.1.1, the grounds referred to by the Opposition Division were discussed with regard to the first auxiliary request.

The second auxiliary request goes in the same direction, but contains an additional limitation intending to overcome the raised novelty objection: the passage "at at least one point in said reaction zone" was replaced by "at **any** point in said reaction zone" (emphasis added). Thus, the reasoning given by the Proprietor given for the first auxiliary request is also valid for the second auxiliary request.

3.1.2 Therefore, the set of claims is admitted into the proceedings.

### 3.2 *Articles 123(2),83,84 EPC 1973*

The Opponent raised objections with regard to Articles 123(2), 83 and 84 EPC 1973. In analogy to the reasoning given for the first auxiliary request and given the fact that the second auxiliary request does not meet the requirement of Article 56 EPC, the Board considers that a discussion of these aspects is not considered necessary.

3.3 *Article 54(1),(2) EPC 1973*

Claim 1 of the second auxiliary request contains the feature "gas superficial velocity of greater than four meters per second". Therefore considerations as made above for the first auxiliary request apply.

3.4 *Article 56 EPC 1973*

The second auxiliary request differs from the first auxiliary request in the feature "at any point" instead of "at one point". However, the teachings concerning gas velocities in D1 and D9 are not limited to only one point. Thus, the considerations given for the first auxiliary request apply accordingly.

## 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 L. Li Voti