

Internal distribution code:

- (A) [] Publication in OJ
(B) [] To Chairmen and Members
(C) [X] To Chairmen
(D) [] No distribution

**Datasheet for the decision
of 7 February 2012**

Case Number: T 1743/09 - 3.3.01

Application Number: 02803666.3

Publication Number: 1458699

IPC: C07D 301/10

Language of the proceedings: EN

Title of invention:

A process and systems for the epoxidation of an olefin

Patentee:

Shell Internationale Research Maatschappij B.V.

Opponents:

THE DOW CHEMICAL COMPANY
Scientific Design Company Inc.
BASF SE

Headword:

-

Relevant legal provisions:

EPC Art. 100(b)
RPBA Art. 13(1), 13(3)

Keyword:

Admissibility of documents not admitted during opposition proceedings (no) - discretion correctly exercised"
"Admissibility of late filed document (no) - no justification, relevance not immediately apparent"
"Main and first auxiliary request: sufficiency of disclosure (no) - values for multiplication factors cannot be determined or verified - undue burden"
"Second to sixth auxiliary request: admissibility (no) - late-filed, objection of insufficiency not overcome"

Decisions cited:

G 0007/93, R 0010/09, T 0087/05

Catchword:

-



Case Number: T 1743/09 - 3.3.01

D E C I S I O N
of the Technical Board of Appeal 3.3.01
of 7 February 2012

Appellant: Shell Internationale Research Maatschappij
(Patent Proprietor) B.V.
Carel van Bylandtlaan 30
NL-2596 HR Den Haag (NL)

Representative: Arnold, Carol Alice; Brown, Julie
Shell International B.V.
Intellectual Property Services
P.O. Box 384
NL-2501 CJ The Hague (NL)

Respondent 1: THE DOW CHEMICAL COMPANY
(Opponent 1) P.O. Box 1967
Midland, Michigan 48674 (US)

Representative: Hayes, Adrian Chetwynd
Boult Wade Tennant
Verulam Gardens
70 Gray's Inn Road
London WC1X 8BT (GB)

Respondent 2: Scientific Design Company Inc.
(Opponent 2) 49 Industrial Avenue
Little Ferry
New Jersey 07643-1901 (US)

Representative: Westendorp, Michael Oliver
Westendorp I Sommer
Uhlandstrasse 2
D-80336 München (DE)

Respondent 3: BASF SE
(Opponent 3) Global Intellectual Property
GVX-C006
D-67056 Ludwigshafen (DE)

Representative: Ellwanger, Arndt
Ellwanger & Kern
Patentanwälte
Friedrichsplatz 9
D-68165 Mannheim (DE)

Decision under appeal: **Decision of the Opposition Division of the
European Patent Office posted 10 June 2009
revoking European patent No. 1458699 pursuant
to Article 101(3)(b) EPC.**

Composition of the Board:

Chairman: P. Ranguis
Members: G. Seufert
 D. S. Rogers

Summary of Facts and Submissions

- I. The Appellant (Patent Proprietor) lodged an appeal against the decision of the Opposition Division revoking the European patent No. 1 458 699.
- II. In this decision the following numbering will be used to refer to the documents:
- (34) Exercise proposal with the heading "Exercise in Routine Experimentation" and response of Mr Craig Bennett
 - (35) Exercise proposal with the heading "Exercise in Routine Experimentation" and response of Mr Zhen Hou
 - (37) Set of "colour slides" referring to "Routine Experimentation Examples for EP 1,458,699 B":
"Determination of Methyl Chloride Factor ("a")",
"Determination of the Ethane Factor ("y")",
Determination of the Temperature Factor ("B")
submitted by the Appellant on 17 January 2012
 - (38) Calculations concerning example 1 of the patent in suit submitted by the Appellant on 2 February 2012
 - (39) Experiments 1-4 submitted by the Appellant with letter of 18 May 2007 during the opposition proceedings
- III. Notices of opposition had been filed by the Respondents 1-3 (Opponent 1-3) requesting revocation of the patent in suit in its entirety on the grounds of lack of novelty and inventive step and insufficiency of disclosure (Articles 100(a) and (b) EPC). In addition, Respondent 2 requested revocation of the patent in suit on the ground that the patent in suit was directed to

subject-matter which was excluded from patentability under Article 52(2) EPC.

- IV. The decision of the Opposition Division was based on a main request filed with letter of 18 May 2007 and an auxiliary request filed during the oral proceedings before the Opposition Division.

The Opposition Division held that the invention was not sufficiently disclosed to be carried out over the whole scope of the claims by a person skilled in the art. In particular, it took the view that the patent in suit lacked information allowing a proper determination of the multiplication factors for all reaction modifiers and factor B, which were necessary to properly calculate the value Q_2 .

- V. With the statement setting out the grounds of appeal, the Appellant defended the patent on the basis of the requests underlying the decision under appeal.

- VI. In a communication accompanying the summons to oral proceedings, the Board expressed its preliminary opinion. In particular, it indicated that the main issue for discussion would be whether the experiments filed by the Appellant were suitable to remedy the alleged lack of sufficient disclosure and whether or not they reflected the routine experimentation which the skilled person with his general knowledge would have considered in order to reliably determine the multiplication factors and the factor B. A further issue would be whether the Opposition Division had correctly exercised its discretion not to admit documents (34) and (35).

- VII. With letter of 17 January 2012 the Appellant filed a new main request, which was identical to the auxiliary request underlying the contested decision, a first auxiliary request, which was almost identical to the main request, and second to sixth auxiliary requests to replace the requests previously on file. Document (37) was also filed.
- VIII. With letter of 30 January 2012 the Appellant filed two declarations by the students who had carried out the responses in the exercise proposals in documents (34) and (35). With a further letter dated 2 February 2012 the Appellant filed document (38).
- IX. At the beginning of the oral proceedings before the Board, which took place on 7 February 2012, the Appellant inverted the order of its main and first auxiliary requests filed on 17 January 2012.

The discussion regarding sufficiency of disclosure during oral proceedings focused on the Appellant's experiments (document (39) provided during opposition proceedings as evidence that the multiplication factors can be determined by routine experimentation, which the skilled person can readily devise in view of the disclosure of the patent in suit and his common general knowledge. In this context, the Chairman stressed the point that the determination of Q_1 and B would appear to be essential for sufficiency of disclosure. He pointed out that the Appellant's experiments would seem to be decisive and invited the parties to present their comments with respect to these experiments. In particular, he drew the parties' attention to a

statement in experiment 2 regarding the value of Q in experiments 1 and 2. After the discussion the chairman informed the parties of the Board's conclusion that main request gave rise to an objection under Article 100(b) EPC, which would also apply to first auxiliary request. He indicated that the same conclusion would also appear to apply to the second to sixth requests which the Board would thus not be inclined to admit. Invited to present its comments, the Appellant did not make further submissions.

- X. The main request (former first auxiliary request, see point IX above) filed on 17 January 2012 consists of 20 claims, independent claim 1 reading as follows:

"1. A process for the epoxidation of ethylene, which process comprises reacting a feed comprising ethylene, oxygen and a reaction modifier in the presence of a highly selective silver-based catalyst at a reaction temperature T, and with the reaction modifier being present in a relative quantity Q which is the ratio of an effective molar quantity of active species of the reaction modifier present in the feed to an effective molar quantity of hydrocarbons present in the feed, and which process comprises the steps of:

- operating at a first operating phase wherein the value of T is T_1 and the value of Q is Q_1 , and
- subsequently operating at a second operating phase at a reaction temperature which is different from the reaction temperature employed in the first operating phase, such that the value of T is T_2 and the value of Q is Q_2 , whereby Q_2 is determined by calculation and Q_2 is defined by the formula

$$Q_2 = Q_1 + B (T_2 - T_1)$$

wherein B denotes a constant factor which is greater than 0 and wherein the reaction modifier comprises an organic chloride.

Independent claim 15 of the main request is directed to a method for making a 1,2-diol or a 1,2-diol ether comprising converting ethylene oxide obtained by a process of claim 1 into 1,2-diol or a 1,2-diol ether. Independent claims 16, 17 and 19 of the main request refer to a reaction system suitable for performing the claimed process, a computer program product suitable for instructing a data processing system of a computer system to execute the calculations for the claimed process and a computer system configured to receive instruction from the computer program product.

The first auxiliary request (former main request, see point IX above) differs from the main request in that the feature that the reaction modifier comprises an organic chloride is missing in independent claim 16 directed to the reaction system.

The second auxiliary request differs from the main request in that in claim 1 and in the independent claim directed to the reaction system the organic chloride comprised in the reaction modifier is selected from one or more of methyl chloride, ethyl chloride, ethylene dichloride and vinyl chloride.

The third auxiliary request differs from the second auxiliary request in that in independent claim 1 and in the independent claim directed to the reaction system

the feature "and the hydrocarbons present in the feed comprise one or more of methane, ethane, propane and cyclopropane, in addition to ethylene" was added.

The fourth auxiliary request is identical to the third auxiliary request with the exception that "methyl chloride" was deleted from the list of organic chloride comprised in the reaction modifier in independent claim 1 and the independent claim directed to the reaction system.

The fifth auxiliary request is based on the third auxiliary request, whereby in independent claim 1 and in the independent claim directed to the reaction system the catalyst was further defined as "comprising silver, rhenium or a compound thereof, a further metal or compound thereof selected from Group IA metals, Group IIA metals, molybdenum, tungsten, chromium, titanium, hafnium, zirconium, vanadium, thallium, thorium, tantalum, niobium, gallium and germanium and mixtures thereof and optionally a rhenium co-promoter selected from one or more of sulfur, phosphorus, boron, and compounds thereof, on a support, in particular an α -alumina support".

The sixth auxiliary request is identical to the fifth auxiliary request with the exception that "methyl chloride" was deleted from the list of organic chloride comprised in the reaction modifier in independent claim 1 and the independent claim directed to the reaction system.

XI. The arguments provided by the Appellant, to the extent that they are relevant for the present decision, can be summarised as follows:

- *Admissibility of documents (34), (35) and (37)*

Documents (34) and (35) should have been admitted by the Opposition Division since they were *prima facie* relevant to the issue under contention. They demonstrated that it was possible for students who had not worked in the art and would not have had gained any knowledge by experience in the art between the priority date and the date they carried out their work, to set-up routine experimentation for the determination of the required multiplication factors. There was nothing to indicate that they used anything other than the teaching of the patent and their common general knowledge.

Document (37) should be admitted into the appeal proceedings. Its subject-matter was directly derivable from the patent in suit. It was therefore unnecessary to provide additional explanations with its submission. Concerning its late date of filing, it was noted that the Board had not set a date for any final submissions.

- *Sufficiency of disclosure*

The patent in suit, taking into account common general knowledge, provided sufficient information for the skilled person to carry out the invention. Concerning the multiplication factors, detailed information was provided in paragraphs [0031] to [0033] of the patent in suit. The multiplication factor for halogen and

nitrate- or nitrite-forming compounds as reaction modifiers was the number of halogen or nitrogen atom in the molecule. Concerning the multiplication factors for the hydrocarbons, it was clear from the patent that these factors reflected the relative ability of the hydrocarbon, as compared to the feed olefin, to remove or strip the modifier from the catalyst surface. Thus, the multiplication factor of the olefin was 1 by definition and for the other hydrocarbons was determined relative to this. Ranges for multiplication factors were given because these factors were not necessarily the same for the same feed component in the same process when a different catalyst was used. For reaction modifiers and hydrocarbons for which the multiplication factor was not already provided, it could be determined by routine experimentation. From the patent in suit certain multiplication factors are known. Setting-up experiments using the known factors, changing just one variable and assessing the response, would allow the skilled person to determine an unknown factor. This was an approach commonly used in the science and engineering art and was illustrated in experiments 1-4 submitted with letter of 18 May 2007 during the opposition proceedings. The assumption that at the same temperature the value of Q in experiment 2 was the same as in experiment 1 was directly derivable from the patent in suit. If there was no change in temperature, it followed directly from the patent's equation that Q_2 was equal to Q_1 . Furthermore, wrapped up in Q are various factors and although at the same temperature the overall value for Q stays the same, the nominator and denominator may change. Contrary to the Respondents' opinion, conducting the experiments 1-4 at the same temperature was not against the teaching of

the patent and allowed simplification of the routine experimentation.

XII. The arguments provided by the Respondent 1, to the extent that they are relevant for the present decision, can be summarised as follows:

- *Admissibility of documents (34), (35) and (37)*

The Opposition Division correctly exercised its discretion not to admit documents (34) and (35). Both documents were late-filed and according to the instruction therein, the students were allowed to refer to any literature, including post-priority date literature, for their responses. On what knowledge the students relied was not apparent. All information was given to them after the priority date. Moreover, since they were graduate students, they were probably still in high school at the time of the priority date. Thus, all their knowledge was acquired after the priority date. The students' declarations provided by the Appellant in the appeal proceedings were irrelevant, since they were not in front of the Opposition Division.

Document (37) was late-filed and no explanation has been provided as to why it was relevant to the issue under contention. The document did not contain information according to the patent. Neither the equation on page 1 nor the tests 1-4 form part of the patent in suit. The subject-matter of document (37) represented further thought experiments by the Appellant.

- *Sufficiency of disclosure*

The patent in suit did not provide sufficient information for the skilled person to be able to reproduce the claimed invention across its whole scope. In the absence of any detailed information on the routine experimentation to be carried out in order to determine the multiplication factors for methyl compounds as reaction modifier or hydrocarbons, which were necessary for the calculation of the effective molar quantity and consequently Q , the skilled person would not know how to determine the appropriate factors. Concerning the Appellant's experiments, there was no suggestion in the patent that these experiments should be carried out. The patent required that there was a temperature difference. Thus, Q_2 to be equivalent to Q_1 was not permitted according to the patent in suit. The assumption in experiment 2 that Q did not change at the same temperature was not present in the patent in suit.

XIII. The arguments provided by the Respondent 2, to the extent that they are relevant for the present decision, can be summarised as follows:

- *Admissibility of documents (34), (35) and (37)*

Document (34) and (35) were not relevant in the present case, since the students for their responses to the exercise in routine experimentation were not provided with the patent in suit, but with another patent, i.e. EP 1 458 698 instead of EP 1 458 699, which differed from the patent in suit in decisive points. Furthermore, the work by the students was done in the

year 2009 and it could not be excluded that the students acquired further knowledge not available at the date of priority.

Document (37) should not be admitted into the appeal proceedings. It was filed late in the proceedings and without any justification. It contained equations which were not in the patent in suit and no explanations were provided by the Appellant as to its relevance to the issue in question. There was also not enough time to have the data reviewed by the Respondent's experts.

- *Sufficiency of disclosure*

The Opposition Division correctly concluded that the invention of the patent in suit was insufficiently disclosed. According to the patent in suit unknown multiplication factors could be determined and verified by routine experimentation without, however, providing any details on how to carry out such experimentation. The Appellant's experiments 1-4 disregarded the only prerequisite of the patent, namely that the temperature was different. Working at the same temperature would render the equation of the patent meaningless, because at the same temperature everything could be left as it was. The assumption that Q_1 is equal to Q_2 if the reaction modifier is changed from ethyl chloride to methyl chloride at the same temperature was nowhere in the patent in suit.

XIV. The arguments provided by the Respondent 3, to the extent that they are relevant for the present decision, can be summarised as follows:

- *Admissibility of documents (34), (35) and (37)*

The decision of the Opposition Division not to admit documents (34) and (35) was correct. The students were allowed to access literature published after the priority date of the patent in suit. Moreover, their responses were based on a different patent.

The submissions of Respondents 1 and 2 with respect to document (37) were fully endorsed. This document was late-filed, complex, introduced equations which were not present in the patent and its filing was not accompanied by any explanation regarding its relevance.

- *Sufficiency of disclosure*

The presently claimed subject-matter was not disclosed in a manner sufficiently complete for it to be carried out by a skilled person over the whole scope of the claims. A proper calculation of Q_2 required that the skilled person was in a position to determine the multiplication factors. The patent in suit did not provide information as to how this should be done. It merely referred to routine experimentation without providing any details as to how exactly this experimentation should be carried out. It was not sufficient that certain specific values were mentioned in the patent in suit, because the skilled person, in view of the disclosed ranges, would have understood that these values were merely exemplary and depended on additional factors. Concerning the Appellant's experiments 1-4 there was in principle nothing to add to the observations and comments provided by Respondent 1 and 2.

- XV. The Appellant requested that the decision under appeal be set aside and that the case be remitted to the department of first instance for further prosecution upon the basis of the main request (formerly the first auxiliary request), or alternatively upon the basis of the first auxiliary request (formerly the main request), or alternatively upon the basis of second to sixth auxiliary requests, all such request filed under cover of a letter dated 17 January 2012; Further the Appellant requested that document (34) and (35) and the slides submitted under cover of a letter of 17 January 2012 be admitted into the proceedings.
- XVI. The Respondents requested that the appeal be dismissed. Further the Respondents requested that the documents (34) and (35), the slides submitted under cover of a letter dated 17 January 2012 and second to sixth auxiliary requests be not admitted into the proceedings.
- XVII. At the end of the oral proceedings the decision of the Board was announced.

Reasons for the Decision

1. The appeal is admissible.
2. Evidence not admitted into the proceedings before the department of first instance.
 - 2.1 In reply to the summons to oral proceedings before the Opposition Division the Appellant filed documents (34) and (35) as evidence for the routine experimentation

mentioned in the patent in suit by which the skilled person would be able to determine the values for the multiplication factors and the factor B. The Opposition Division decided not to admit these documents into the proceedings for the reason that "the students (who developed the experimental protocols for the routine experimentation, annotation by the Board) were allowed to use any open literature available to them including also publications after the priority date of the presently disputed patent". In addition, the Opposition Division took the view that these documents were not *prima facie* highly relevant, because only theoretical procedures were described which had not been put into practice (point 3 of the Reasons of the decision under appeal). The decision not to admit these documents was challenged by the Appellant.

- 2.2 If the way in which a department of first instance has exercised its discretion on a procedural matter is challenged in an appeal, it is not the task of the Board of Appeal to review all the facts and circumstances as if it were in the place of the first instance, and to decide whether or not it would have exercised such discretion in the same way. Thus, a Board of Appeal should only overrule the way in which a department of first instance has exercised its discretion if it comes to the conclusion that either the department of first instance has not exercised its discretion in accordance with the right principles, or that it has exercised its discretion in an unreasonable way, and has thus exceeded the proper limit of its discretion (G 7/93, OJ 1994, 775, point 2.6 of the reasons).

2.3 In the present case the Board finds that the department of first instance has exercised its discretion correctly and in a reasonable way. The patent in suit refers in general to routine experimentation for the determination of the multiplication factors and the factor B without providing any information as to how the experimentation should be performed. Documents (34) and (35) were filed as evidence that it was possible to devise routine experimentation in order to determine the required factors with only the information given in the patent in suit and common general knowledge. The documents with the title "Exercise in "Routine Experimentation"" consist of two parts. In the first part the background is explained. The problem is stated and the students are invited by Mr Scott Baker to develop an experimental protocol for the determination of individual effectiveness factors in the ratio Q. The second part provides the students' answers. According to the instructions given to them by Mr Baker, the students were allowed to use **"the open literature** including textbooks and **their** general knowledge in chemistry, catalysis, reaction engineering and experimental design". In other words, they were free to access any information available to them at the time they devised the experimental protocols, including the electronic file of the patent in suit, and to rely on general knowledge, which may not have been available to the person skilled in the art at the priority date of the patent in suit. The protocols were devised in 2009, 8 years after the priority date of the patent in suit. It is not apparent from the instructions given to the students that they had been made aware of the significance of this date for the development of their experimental protocols. Nor is there any indication in

the students' responses on which information or general knowledge they relied. Thus, admitting these documents into the opposition proceedings would have involved the risk of relying on information or knowledge which might have been acquired after the priority date of the patent in suit. The Board therefore concludes that for this reason alone the Opposition Division was within its right to refuse to admit them into the proceedings.

In view of the above, there was no need to decide on the admissibility of declarations by the students concerning this issue which were submitted by the Appellant for the first time a week before oral proceedings before the Board.

3. Admissibility of late filed documents

3.1 With letter of 17 January 2012, shortly before the oral proceedings before the Board, the Appellant filed "a set of colour slides" (pages) that it **may refer to** in oral proceedings" (document (37)). No justification for the late filing or explanation as to the relevance of document (37) with regard to the points at issue was provided. According to the Appellant the subject-matter in these slides was directly derivable from the patent in suit, in particular from the indicated passages. No further explanations were therefore necessary.

3.2 Contrary to the Appellant's assertion, the Board notes that document (37) does not refer to any passages of the patent in suit. The first page (slide) of document (37) mentions the equation of the patent in suit, i.e. $Q_2 = Q_1 + B (T_2 - T_1)$, followed by a complex equation for a system of reaction modifiers and

hydrocarbons consisting of methyl chloride, ethyl chloride, vinyl chloride, ethylene dichloride, ethylene, ethane and methane. Such a specific system is not described in the patent in suit. The working example 1 and the hypothetical example 2 of the patent refer to a system using ethylene and ethyl chloride at increasing temperatures. The second page (slide) under the heading determination of the methyl chloride factor refers to two tests, test 1 using only ethyl chloride and ethylene in the feed and test 2 using only methyl chloride and ethylene in the feed. The tests are run at the same temperature. However, neither test 1 nor test 2 is present in the patent in suit. Nor is there an explanation offered why the temperature in test 1 and 2 should be the same in view of the fact that the process of the patent in suit requires a temperature change. Furthermore, in order to calculate the multiplication factor "a" for methyl chloride, the Appellant started from the complex equation described on the first page of document (37) without providing any reasons or explanations for doing so. Similar considerations apply to pages 3 and 4 of document (37).

3.3 Since the relevance of document (37) to the points at issue was not immediately apparent and no explanation as to its relevance was provided by the Appellant, the Board in exercising its discretion under Article 114(2) EPC decided not to admit this document into the proceedings.

3.4 During the oral proceedings the Appellant offered that Mr Kobe, their technical expert and one of the inventors of the patent in suit, could provide the necessary explanations with respect to document (37).

This offer was not considered by the Board, since it would have placed the Respondents, who in the absence of prior explanations could only have speculated on the Appellant's line of thinking, at a substantial disadvantage vis-à-vis the Appellant. Moreover, accepting explanation by Mr Kobe at this stage of the proceedings might have made adjournment of the oral proceedings necessary in order to allow the Respondents to adequately react to the situation. Thus, procedural economy also spoke against the admission of document (37) (Article 13(1) and (3) RPBA).

- 3.5 Document (38) was submitted by the Appellant with letter of 2 February 2012. It summarises and graphically illustrates the results of example 1 of the patent in suit and does not confront the Respondents with new facts or evidence. None of the Respondents objected to its admission. Hence, the Board decided to admit this document into the proceedings.

Main request

4. *Amendments*

Claim 1 of the main request has been amended compared to the claims as granted by restricting the epoxidation process to an epoxidation process of ethylene and by making the presence of an organic chloride obligatory. These amendments are based on claim 2 of the application as filed. Independent claims 15, 16, 17 and 19 referring to the use of ethylene oxide, a reaction system for performing the epoxidation process and a computer program product and computer system for its control have been amended accordingly. The main

request therefore complies with Article 123(2) and (3) EPC. No objections with respect to this issue have been raised by the Respondents.

5. Sufficiency of disclosure (Article 100(b))

5.1 The Respondents raised an objection under Article 100(b) EPC against the patent in suit. The question to be examined in the present case is therefore whether the patent in suit as a whole discloses the invention in a manner sufficiently clear and complete for it to be carried out by a person skilled in the art.

It is established jurisprudence of the Boards of Appeal that an invention is sufficiently disclosed if it can be performed by a person skilled in the art without undue burden in the whole area claimed, using common general knowledge and taking into account further information given in the description of the patent or patent application.

5.2 Claim 1 of the main request is concerned with an epoxidation process which is carried out in the presence of a highly selective silver-based catalyst and a reaction modifier at a reaction temperature T . The reaction modifier is present in a relative quantity Q , which is the ratio of an **effective molar quantity** of active species of the reaction modifier present in the feed to an **effective molar quantity** of hydrocarbon present in the feed. The process is operated at a first operating phase wherein the value of T is T_1 and Q is Q_1 and subsequently operated at a second operating phase with a reaction temperature which is **different** compared to the temperature in the first operating phase such

that the value of T is T_2 and Q is Q_2 whereby Q_2 is determined by calculation and Q_2 is defined by the formula $Q_2 = Q_1 + B (T_2 - T_1)$. This enables the operator of an epoxidation process to predetermine an appropriate change in the value of Q, and therefore in the composition of the reaction modifier and/or the hydrocarbons, in response to a change in the reaction temperature and as a consequence to reduce or prevent undesirable deviations of the selectivity from a certain, preferably the optimum, level (paragraph [0011] of the patent in suit). The parameter Q and therefore the effective molar quantity are thus critical parameters of the process, indispensable for achieving the goal of the invention.

- 5.3 According to the patent in suit (see paragraphs [0030] to [0032]) the effective molar quantity of active species of the reaction modifier is determined by multiplying the molar quantity ($[RM]$) of the reaction modifier with a "multiplication factor" (F_{RM}). If several reaction modifiers are present, which is frequently the case in practice, the effective molar quantity of active species may be determined by multiplying the molar quantity of each of the reaction modifiers present in the feed with a multiplication factor and adding up the resulting multiplication products. Concerning the multiplication factors of the reaction modifier, the patent in suit states that the multiplication factors represent the number of active heteroatoms, in particular halogen atoms and/or nitrogen atoms, present per molecule of the reaction modifier. This implies that, for example, the multiplication factor for ethyl chloride as reaction modifier is 1, for ethylene dichloride 2, for nitric

oxide or nitropropane 1 (paragraph [0024] of the patent in suit), etc. However, according to the patent in suit, reaction modifiers which are methyl compounds such as methyl chloride or methyl bromide are apparently an exception to that "rule" and their multiplication factors may vary between 2 to 5 (column 9, lines 21-25 of the patent in suit). According to column 9, lines 27 to 28 of the patent in suit, the factors for these compounds can be determined and verified by **routine experimentation.**

- 5.4 Similarly, the effective molar amount of the hydrocarbons is defined in the patent in suit (see paragraph [0033]) as the multiplication product of the molar quantity of the hydrocarbon ([HC]) with a multiplication factor (F_{HC}). According to the patent, the multiplication factor for ethylene is 1 by definition. The factor for methane may be at most 0.5, the factor for ethane may be in the range of from 50 to 150 and the factor for higher hydrocarbons in the range of 10 to 10000. According to column 10, lines 12-14, these factors may be determined and verified by **routine experimentation.**

As explained in the patent (paragraph [0009]) and by the Appellant in its statement of grounds of appeal, the reason for using the effective molar quantity rather than the actual molar quantities is that it takes account of differences in the behaviour of different reaction modifiers and different hydrocarbons. The nature of the catalyst, the reaction modifier and the hydrocarbon are relevant to the value of the multiplication factor, which thus is "a reflection of the chemical/physical interaction between

the catalyst and the component". As a consequence the multiplication factors are not necessarily the same for the same feed, if a different catalyst is used. For these reasons, ranges rather than a single specific value are present for the multiplication factors of certain reaction modifiers or the hydrocarbons.

- 5.5 The patent in suit does not contain a method for the determination of the required multiplication factors. For the reaction modifiers it merely states that the multiplication factors are equivalent to the number of active heteroatoms present per molecule of the reaction modifier, except for methyl compounds, without providing any information as to how this has been established or how it could be verified. Neither example 1 of the patent in suit nor example 2, which is merely a hypothetical example, describes the determination of multiplication factors. Concerned with the system ethyl chloride/ethylene the examples rely on the multiplication factors provided in the patent in suit, namely 1 by definition for both compounds.

For the reaction modifier and hydrocarbons for which a range for the multiplication factors has been provided, the patent in suit also fails to describe the routine experimentation which the person skilled in the art should carry out in order to determine the specific multiplication factor to be used for a particular compound under particular circumstances, i.e. for a particular catalyst.

Furthermore, there is no evidence on file that these multiplication factors were parameters commonly known or used in epoxidation processes of the prior art.

5.6 The Appellant provided additional experiments during the opposition procedure as evidence that reliable determination of the multiplication factors involves nothing more than simple routine experimentation as mentioned in the patent in suit (document (39)). According to the Appellant, with certain multiplication factors being known from the patent in suit, all the skilled person needed to do was to set-up experiments using the known factors, whereby one variable is changed and the response assessed in order to allow an unknown factor to be determined. Such an approach was common and routine in the science and engineering art and was reflected in the experiments 1-4 of document (39).

5.7 Document (39) describes four experiments. Experiment 1, which is characterised as reference experiment, repeats the reaction conditions 1 of example 1 of the patent in suit using ethylene as reaction modifier and ethylene as the only hydrocarbon. At optimum selectivity the concentration of the reaction modifier ethyl chloride ([EC]) is 2.9×10^{-4} mole-% and the concentration of ethylene ([E]) is 28 mole-%. With the multiplication factors (F_{RM}) of ethyl chloride and ethylene being equal to 1 according to the patent in suit, Q is determined ($Q = (F_{RM} \times [RM]) / (F_{HC} \times [HC])$, i.e. $(F_{EC} \times [EC]) / (F_E \times [E])$). In experiment 2 the reaction modifier is changed from ethyl chloride to methyl chloride after the reaction conditions of experiment 1 are reached. Then the concentration of methyl chloride is adjusted to attain optimal selectivity, which is reached at a concentration of 8.8×10^{-4} mole-%. Then experiment 2 states that "Because this experiment is conducted at

- the same temperature as experiment 1, the value of Q under these conditions must essentially be the same as the value for Q for experiment 1, **in accordance with the teaching of the patent**". According to experiment 2 using the value of Q_1 as obtained in experiment 1 it follows that $(F_{MC} \times 8.8 \times 10^{-4}) / (28 \times 1) = 10.4 \times 10^{-6}$ from which $F_{MC} = 0.33$ is calculated.
- 5.8 In the Board's view, the assumption that at the same temperature Q for the system ethyl chloride/ethylene must be equal to methyl chloride/ethylene is however not derivable from the patent in suit. It is an assumption which the person skilled in the art has no reason to make and seems to be based on knowledge only available to the Appellant.
- 5.9 According to the Appellant this feature followed directly from the equation $Q_2 = Q_1 + B (T_2 - T_1)$ of the patent in suit. If T_2 equals T_1 the term $B (T_2 - T_1)$ was zero and, as a consequence $Q_2 = Q_1$. Further support could be found in paragraph [0011] of the patent in suit.
- 5.10 In the Board's view such a purely formalistic view is not justified in the present case. According to the patent in suit the present invention is based on the finding that the position of the selectivity curve for the modifier shifts proportionally with the change in temperature. Thus, when the temperature is increased or decreased in the course of an epoxidation reaction, Q and thus the amount of reaction modifier and/or hydrocarbon is adjusted proportionally to the change in temperature in order to prevent deviation from the preferably optimum selectivity (paragraphs [0010] and

[0011] of the patent in suit). The change in temperature is a prerequisite of the present invention and there is no indication in the patent in suit that for the routine experimentation referred to in the patent in suit for the determination of the multiplication factors this prerequisite should be disregarded. Moreover, according to the patent in suit Q needs to be adjusted in response to a change in temperature, which also means that there is no need for the skilled person to adjust Q when the temperature stays the same. In other words, when no temperature change occurs, the reaction modifier(s) and the hydrocarbon(s) and their respective amounts simply remain unchanged. Thus, in the Board's view, according to the teaching of the patent, the equation $Q_2 = Q_1$ when $T_2 = T_1$ is valid for the same feed (reaction modifier(s) and hydrocarbon(s)) reflecting the situation where no temperature change occurs during the epoxidation reaction. The equivalence of Q_2 and Q_1 when the reaction modifier is changed from ethyl chloride to methyl chloride as mentioned in experiment 2 of document (39) is not taught in the patent in suit including paragraph [0011] and thus a consideration the skilled person would not take into account. The same considerations also apply with respect to experiment 3, where the hydrocarbon has changed from ethylene to ethylene plus ethane and Q_1 for the system ethyl chloride/ethylene has been equated to Q_2 for the system ethyl chloride/ethylene/ethane. The Appellant's experiments cannot therefore be used as evidence for the kind of "routine experimentation" the skilled person, based on the teaching of the patent in suit, would consider in order to determine the required multiplication factors.

5.11 The Appellant argued that according to the patent in suit a change in temperature was not required. This was apparent from paragraphs [0010], [0037] and [0040] of the patent in suit. The equation of the patent could therefore be simplified accordingly for the purpose of determining the multiplication factors by routine experimentation. Furthermore, the Appellant argued that wrapped up in Q were varying factors. If the temperature was the same, the overall value of Q according to the patent stayed the same. The nominator and denominator, however, might change.

5.12 The Board is not convinced by the Appellant's arguments. According to claim 1 of the patent in suit the temperature in the first and the second operating step are different. The temperature change is thus an essential feature of the claimed subject-matter. All paragraphs cited by the Appellant refer to a temperature differences, or an increase or decrease in temperature. Paragraph [0010] mentions the proportionality between the shift of the selectivity curve to a higher or lower value of Q and the change in temperature. Paragraph [0037] refers to the wide range of reaction temperatures to be used according to the invention and to a weight average temperature to be used in case the reaction temperature is not the same at every catalyst particle. It does not state that the reaction temperature in operating phase 1 and 2 of the claimed patent may be the same. On the contrary, paragraph [0037] still refers to the temperature difference $T_2 - T_1$. Paragraph [0040] merely refers to reasons for a change in temperature. The skilled person had thus no reason to base its routine experimentation for the determination of the multiplication factors on

experiments working at the same temperature without being provided with explicit information in the patent in suit for doing so. With respect to the factor wrapped up in Q , the Board observes that according to the patent in suit when there are several reaction modifiers and/or several hydrocarbons present in the epoxidation process the nominator and the denominator in Q represent the sum of the multiplication products of the molar quantity of the modifiers (nominator) or the hydrocarbon (denominator) with the multiplication factor (paragraphs [0032] and [0033] of the patent in suit). An increase in temperature requires an increase in Q and *vice versa*. This can be done by changing either the nominator or the denominator. However, as explained in point 5.10 above, if no temperature change occurs there is no reason for the skilled person to change anything. Thus, the nominator and the denominator will stay the same, since the amount of reaction modifier and hydrocarbons stays the same.

- 5.13 It follows from the above that in the absence of any information in the patent in suit as to the details of the routine experimentation necessary for the determination or verification of the multiplication factors the skilled person is not in a position to determine and verify appropriate multiplication factors for the hydrocarbons or specific reaction modifiers for a given catalyst system. With inappropriate multiplication factors it is however impossible to calculate the proper value for Q_2 , proper value meaning that value that is necessary to avoid or reduce undesirable deviations from optimum selectivity when the temperature is changed. In order to be able to carry out the invention over the whole scope of the

claims, particularly when using methyl compounds and/or hydrocarbons other than ethylene or complex mixtures, the skilled person would have to arbitrarily select for a specific catalyst system certain values for the multiplication factors and/or hydrocarbons from the range given in the patent in suit, calculate Q_2 and then verify experimentally whether the intended result of working at optimum selectivity is achieved. In case of failure, he needs to repeat the whole procedure without knowing which factor or factors, in case of a complex system with more than one reaction modifier and more than one hydrocarbon, to choose next. In the Board's view this amounts to undue burden.

Accordingly, the Board concludes that the process of claim 1 of the main request is insufficiently disclosed within the meaning of Article 100(b) EPC.

In view of the above there is no need to examine in addition whether or not the patent in suit provides sufficient information to determine and verify the factor "B".

First auxiliary request

6. Sufficiency of disclosure

In the first auxiliary request claim 1 is identical to claim 1 of the main request. Thus, the same considerations and conclusion as in point 5.8 - 5.13 with respect to the main request also apply to claim 1 of the first auxiliary request, with the consequence that this request must also be refused for lack of sufficient disclosure (Article 100(b) EPC).

Second to sixth auxiliary requests

7. Admissibility

7.1 The second to sixth auxiliary request were filed less than one month before oral proceedings. The Respondents objected to any of the request being admitted into the appeal proceedings on the grounds that they were late-filed and that the Appellant had not provided any explanation as to why these requests were suitable to address the issue of insufficiency of disclosure.

7.2 Admission into the proceedings of requests filed at a late stage of the appeal proceedings is a matter of discretion for the Boards of Appeal (R 10/09 of 22 June 2010, point 2.1 of the Reasons). That discretion shall be exercised in view of inter alia the complexity of the new subject-matter submitted, the current state of the proceedings and the need for procedural economy (Rule 13(1) RPBA). Amendments to a party's case after oral proceedings have been arranged shall not be admitted if they raise issues which cannot be dealt with without adjournment of the oral proceedings (Rule 13(3) RPBA).

7.3 An approach commonly adopted by the Boards of Appeal when exercising its discretion is to consider whether or not the amended claims of late-filed requests are clearly allowable in the sense that they do not raise new issues and at the same time are apparently suitable to overcome the existing objections (T 87/05 of 4 September 2007, point 2 of the Reasons).

7.4 Claim 1 of the second to sixth auxiliary requests has been amended by making the presence of certain reaction modifiers (second auxiliary request) and in addition certain hydrocarbons (third and fourth auxiliary requests) obligatory. In the fifth and sixth auxiliary requests the catalyst has been further specified in addition to the specification of the reaction modifiers and the hydrocarbons. The reaction modifiers have been specified to comprise one or of more methyl chloride (which is deleted in the fourth and sixth auxiliary requests), ethyl chloride, ethylene dichloride, vinyl chloride. The hydrocarbons present in the feed comprise one or more methane, ethane, propane and cyclopropane. These additions however do not alter the fact that the skilled person is not provided with sufficient information on how to determine and verify for a specific catalyst the correct multiplication factors for methyl chloride (if present), methane, ethane, propane and cyclopropane or any other reaction modifier or hydrocarbon, which can be present, in order to achieve the goal of the invention. The Board notes that there are "specific" values mentioned in the patent in suit for the aforementioned compounds. It is, however, not apparent to which specific catalyst these values are linked. Moreover, they still can change according to circumstances; the value for the multiplication factor of ethane, for example, is described as "about 85". As a consequence, the objection of lack of sufficient disclosure raised against the main request would still apply, which would necessarily result in the same conclusion that the requirement of Article 100(b) EPC is not fulfilled.

Accordingly, the Board decided not to admit the second to sixth auxiliary request, since they were not clearly allowable.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar:

The Chairman:

A. Counillon

P. Ranguis