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**Datasheet for the decision  
of 5 September 2023**

**Case Number:** T 0765/21 - 3.3.06

**Application Number:** 13706844.1

**Publication Number:** 2830758

**IPC:** B01J23/648, C07C5/333,  
C07C5/48, C07C51/215,  
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B01J23/00, B01J23/652,  
B01J35/02, B01J37/00,  
B01J27/057

**Language of the proceedings:** EN

**Title of invention:**

PROCESS FOR MAKING ETHYLENE AND ACETIC ACID

**Patent Proprietor:**

Rohm and Haas Company

**Opponent:**

Clariant Produkte (Deutschland) GmbH

**Headword:**

Rohm and Haass Company/Process for making ethylene and acetic acid

**Relevant legal provisions:**

EPC Art. 100(a), 56, 117(1)(e)

EPC R. 118

RPBA 2020 Art. 13(1), 13(2)

**Keyword:**

Grounds for opposition - lack of patentability (yes)

Request to allow the accompanying technical expert to make oral submissions - not granted

Inventive step - (no) - effect not made credible within the whole scope of claim

Amendment after summons - exceptional circumstances (no)

Amendment to appeal case - amendment gives rise to new objections (yes)

**Decisions cited:**

G 0004/95

**Catchword:**



**Beschwerdekammern**

**Boards of Appeal**

**Chambres de recours**

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Case Number: T 0765/21 - 3.3.06

**D E C I S I O N**  
**of Technical Board of Appeal 3.3.06**  
**of 5 September 2023**

**Appellant:** Clariant Produkte (Deutschland) GmbH  
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**Respondent:** Rohm and Haas Company  
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**Decision under appeal:** **Decision of the Opposition Division of the  
European Patent Office posted on 8 April 2021  
rejecting the opposition filed against European  
patent No. 2830758 pursuant to Article 101(2)  
EPC.**

**Composition of the Board:**

**Chairman** L. Li Voti  
**Members:** S. Arrojo  
C. Heath

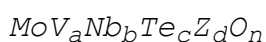
## **Summary of Facts and Submissions**

- I. An appeal was filed by the opponent (from now on "the appellant") contesting **the decision of the opposition division to reject the opposition against European patent No. 2 830 758.**
- II. In the statement of grounds of appeal, the appellant requested that the above decision be set aside and the patent be revoked on the grounds that the invention as granted was insufficiently disclosed, was not novel with respect to D1 or D2, and was not inventive starting from D1, D2, D4 or D7. The invention in auxiliary requests 1 and 2 as filed during first instance proceedings did not meet the requirements of Articles 123(2), 84 and 83 EPC and was not novel or inventive with respect to D1 or starting from D7, D9 or D10. The invention in auxiliary request 3 was insufficiently disclosed, not novel in view of D1 and not inventive.
- III. The above citations correspond to the following documents:
- D1:** DE 196 30 832  
**D2:** US 7,304,014  
**D4:** JP H07-53414 (28.02.1995)  
**D4a:** English translation of D4  
**D7:** Thorsteinson et al. "The oxidative dehydrogenation of ethane over catalysts containing mixed oxides of molybdenum and vanadium." Journal of Catalysis 1978, 52 (1), 116-132  
**D9:** WO 00/69802  
**D10:** US 6,383,977.

IV. In its reply filed on 29 December 2021, the proprietor and respondent requested that the appeal be dismissed and the patent be maintained as granted or, as an auxiliary measure, that the patent be maintained on the basis of one of the auxiliary requests 1 to 4 filed therewith, auxiliary requests 1 to 3 corresponding to the three auxiliary requests filed in the first instance and auxiliary request 4 being filed for the first time in the appeal proceedings.

V. Claim 1 as granted (**main request**) reads:

*"1. A process comprising catalytically converting ethane to ethylene and acetic acid in the presence of oxygen at a temperature of 450°C or less in the gas phase wherein the catalyst has the empirical formula*



*wherein*

*Z is Pd,*

*a = 0.01 to less than 1.0,*

*b = 0.01 to less than 1.0,*

*c = 0.01 to less than 1.0,*

*d is greater than 0 and less than 1.0 and*

*n is determined by the oxidation states of the other elements."*

VI. In its preliminary opinion, the Board concluded that the subject-matter of claim 1 as granted did not involve an inventive step in view of document D1, that auxiliary requests 1 to 3 did not appear to overcome this objection, and that auxiliary request 4 should not be admitted into the appeal proceedings.

VII. By submission dated 28 June 2023 and in response to the Board's preliminary opinion, the proprietor withdrew auxiliary requests 2, 3 and 4 and replaced auxiliary request 1 with new auxiliary requests 1 and 2. The proprietor also filed new document **D11** (US 6,194,610 B1).

VIII. Claim 1 of **auxiliary request 1** differs from that of the main request in that it requires that "*the conversion of ethane is of at least 10%, the selectivity to ethylene is greater than 75%, and the selectivity to acetic acid greater than 15.*"

Claim 1 of **auxiliary request 2** differs from that of auxiliary request 1 in that the process is carried out "*at a temperature of from 150°C to 450°C and at a pressure of from 101,325 kPa to 3039,750 kPa (1 to 30 atmosphere absolute)*" and reads "*... selectivity to acetic acid greater than 15%*".

IX. By submission dated 21 August 2023, the proprietor indicated that Mr. Jingsuo Xu, an employee of the proprietor, would attend the oral proceedings and requested that he be allowed to make oral contributions as a technical expert at the hearing.

X. The oral proceedings before the Board took place on 5 September 2023. Before the proceedings were closed, the parties confirmed that the present decision should be based on the following requests:

- The opponent-appellant requests that the contested decision be set aside and the patent be revoked in its entirety.

- The proprietor-respondent requests that the appeal be dismissed and the patent be maintained as granted or, as an auxiliary measure, on the basis of one of auxiliary requests 1 and 2 attached to the submission dated 28 June 2023.

## **Reasons for the Decision**

1. Hearing of the technical expert
  - 1.1 At the oral proceedings before the Board, the proprietor referred to their request to allow oral contributions by the accompanying technical expert Mr. Xu.
  - 1.2 The appellant requested that the technical expert not be allowed to make oral submissions, arguing that the proprietor's request had been filed late and that no indication had been provided as to Mr Xu's professional qualifications or the content of his oral submissions.
  - 1.3 At the request of the proprietor, the Board deliberated and concluded that Mr. Xu should not be allowed to make oral submissions. The reasons for this conclusion are the following:
    - 1.3.1 In view of the proprietor's request (see submission of 21 August 2023) to allow Mr. Xu to "speak at the Oral Proceedings", and the fact that no request has been made to summon Mr. Xu under Article 117(1)(e) EPC and Rule 118 EPC, the Board concludes that Mr. Xu should be considered as an accompanying person within the meaning of decision **G 4/95**.

1.3.2 As indicated in **G 4/95** (see Headnote), oral submissions by persons accompanying professional representatives but not covered by Article 117 EPC cannot be made as a matter of right, but only at the discretion of the Board. The criteria for deciding whether the accompanying person should be allowed to speak at the hearing include, *inter alia*, that the request should be made sufficiently in advance, indicating the name and qualifications of the accompanying person and specifying the subject-matter of the proposed oral submissions. Moreover, a request made shortly before oral proceedings should, in the absence of exceptional circumstances, be refused unless the opposing party consents.

1.3.3 In view of the fact that the request to hear Mr. Xu was submitted shortly before the oral proceedings (i.e. on 21 August, some two weeks before the hearing) without any indication of his qualification or the nature of his intended contribution, the request does not meet the above-mentioned criteria in **G 4/95**. As the opponent did not agree to allow Mr. Xu to make oral submissions, the Board has concluded that the appellant's request should not be granted.

2. Main request - Inventive step

The Board has concluded that the opposition ground under Article 100(a) EPC in combination with Article 56 EPC prejudices the maintenance of the patent as granted for the following reasons:



2.1 Closest prior art

- 2.1.1 Document D1 discloses a process for the conversion of ethane and/or ethylene to acetic acid in the presence of a palladium containing catalyst.

The examples 1, 2 and 5 to 9 of D1 (see table 1 on page 6) disclose processes for the catalytic conversion of a gas containing ethane, oxygen, nitrogen and water into acetic acid, ethylene and CO/CO<sub>2</sub>. The exemplary catalysts (I) and (II) used in these tests contain Mo, V, Nb and Pd in proportions falling within the scope of claim 1 in combination with oxygen (see page 2, lines 50-51 and page 6, line 24). Document D1 also discloses a list of six preferred catalysts including one having the formula  $Mo_{1,00}V_{0,50}Nb_{0,15}Te_{0,2}Pd_{0,0002}$ , which falls within the scope of claim 1 (see page 3, line 18 and claim 8). However, this tellurium-containing catalyst is not used in any of the above cited examples in table 1.

- 2.1.2 The opposition division held that, while D1 disclosed that the catalysts should be used "in combination with oxygen" (page 2, line 51 and page 3, line 7; claim 1), it did not clearly disclose that the catalysts contained mixed metal oxides.

- 2.1.3 The Board disagrees with this finding because the cited paragraphs on pages 2 and 3 do not refer to the use of a catalyst in combination with oxygen (i.e. a catalyst contacted with gaseous oxygen when in use), but to a catalyst containing certain metals combined with oxygen, which implies that the metals are in their oxidised form. This conclusion was not further contested by the proprietor at the oral proceedings.

2.1.4 The proprietor argued that D1 should not be considered as the closest prior art, because it explicitly concerned a process for the selective production of acetic acid in which ethylene was only generated as a by-product. Since the invention related to a process for the simultaneous synthesis of both ethylene and acetic acid, the skilled person would not have considered D1 as the closest prior art. Furthermore, if the skilled person had considered starting from D1, it would have done so taking the experiments 10-15 in table 1 (using catalysts (III) and (IV)) as the most promising springboard, because these were the only processes intentionally producing both ethylene and acetic acid.

2.1.5 The Board disagrees with the proprietor and considers that D1 represents a suitable starting point as it is in the same technical field and relates to the same type of process as the invention. This is apparent from the prior art cited in D1 (see page 2, lines 30-31), which refers to processes producing both ethylene and acetic acid as part of the background art, and also from the exemplary processes in Table 1, particularly when considering that claim 1 at issue does not require any specific amount of ethylene and acetic acid to be produced. The fact that D1 focuses on the selective production of acetic acid does not imply that the production of ethylene is undesirable or should somehow be avoided, but simply that the proposed solutions are designed to increase the relative production of acetic acid over that of ethylene, i.e. that the production of ethylene is of secondary importance.

2.1.6 The Board is also not convinced that the skilled person would consider the comparative examples with catalysts

(III) and (IV) in table 1 of D1 as the only valid starting points. In fact, the experiments carried out with catalysts (III) and (IV) are presented as disadvantageous compared to those with catalysts (I) or (II) (see comparison of catalysts (IV) and (I) in Table 2). In any case, there is no doubt that experiments 1, 2 and 5-9 using catalysts (I) and (II) constitute a direct and unambiguous disclosure of a catalytic oxidation process of ethane leading to the formation of both acetic acid and ethylene. Since this disclosure is made in the same (or at least a very similar) technical context as the invention, there is no reason for the person skilled in the art to disregard it as a possible starting point, irrespective of whether or not there are other alternatives which might be regarded as a more promising springboard.

2.1.7 In view of the above, the Board will formulate the inventive step argumentation using the exemplary processes 1, 2 and 5-9 in table 1 of D1 as the starting point. Since these tests are not carried out with the tellurium containing catalyst disclosed in other parts of this document, the subject-matter of claim 1 differs from the closest prior art in that the formula of the catalyst contains 0,01 to less than 1,0 of tellurium.

2.2 Problem solved by the invention

2.2.1 According to paras. [0002] and [0008] of the patent, the problem solved by the invention is to provide a catalytic oxidation process for converting ethane to ethylene and acetic acid with good conversion and selectivity. In par. [0010] it is indicated that the process can be surprisingly operated at very high selectivity to ethylene, which according to the examples (see "Preparation 1" in par. [0039], examples

1, 2, 4 and 5 and par. [0042]) is achieved by using a Mo/V/Te/Nb catalyst (i.e. with no Pd). In one embodiment (see last sentence in par. [0035]), the invention provides a ratio of ethylene to acetic acid of less than 2, that is, a comparatively higher selectivity to acetic acid. This effect is associated with a Mo/V/Te/Nb/Pd catalyst according to the "Preparation 2" in par. [0040], examples 3 and 6 and par. [0044].

- 2.2.2 The proprietor argued that D1 did not anticipate a process intended to produce both ethylene and acetic acid, so the problem solved would be the provision of a process which simultaneously produced these substances. In particular, D1 made it clear that there was no intention to produce ethylene. This was reflected in the low selectivity towards ethylene observed in the examples of table 1, which implied that ethylene was an unwanted by-product rather than an actual product of the process.
- 2.2.3 The Board however notes that the production of ethylene is directly and unambiguously disclosed in the exemplary processes 1, 2 and 5-9 in table 1 of D1. The low selectivity values towards ethylene do not mean that this product is only obtained in trace amounts, but simply that the process produces higher amounts of acetic acid than of ethylene. Since claim 1 at issue does not define a minimum selectivity towards ethylene, the Board concludes that D1 anticipates a process which simultaneously produces acetic acid and ethylene as defined in claim 1.
- 2.2.4 In view of this conclusion, the proprietor presented a second line of argumentation: the results obtained in the experiments described in the patent would show that

the process according to the invention provided an overall selectivity towards ethylene and acetic acid significantly higher than that obtained with the D1 process. It could therefore be concluded that the catalyst according to the invention gave rise to the effect of increasing the overall selectivity towards ethylene and acetic acid, so that the problem solved by the invention was to provide a process with a higher overall selectivity towards ethylene and acetic acid.

2.2.5 The Board does not dispute that the overall selectivity towards ethylene and acetic acid obtained in examples 3 and 6 of the patent (the only ones falling within the scope of claim 1 at issue) is higher than that observed in the examples cited as the closest prior art. However, it should be noted that claim 1 relates to a catalytic process and not to the catalyst per se, so that the invention could only be considered to provide such a high overall selectivity if there were evidence that this effect was related to the use of the catalyst (and not to any other feature or combination of features) and that it would be obtained for substantially any process falling within the scope of protection. Examples 3 and 6 of the patent are not considered to provide sufficient evidence in this respect, because there are no comparative examples illustrating the effect of the catalyst as such. In addition, the examples cover a very narrow range of operating conditions and a single catalyst, which is insufficient to conclude that similar results would be obtained for any catalyst and operating conditions falling within the broad scope of claim 1.

2.2.6 In this respect, the appellant counter-argued that it was common practice to assume that the effects observed

in the examples would also be achieved beyond their narrow scope.

- 2.2.7 While the Board agrees that it is common practice to extrapolate to some extent the technical effects observed in the examples, it should be considered whether the required assumptions can still be reasonably made when the scope of protection is significantly broader than that of the examples.

If a patent associates certain feature(s) with an effect and provides examples showing that this effect would be achieved over a broad scope, then it can generally be assumed that an invention comprising these essential feature(s) would produce the desired effect, even if the scope of protection is quite broad. On the other hand, if it is unclear from the teachings of the patent which specific aspect(s) are essential for obtaining an effect and/or if the effect is shown to be obtained only within a very limited scope, then there will normally be no basis for assuming that this effect would be obtained over the whole scope of a broad claim.

As indicated above, the patent does not provide any comparison between processes using a catalyst as defined in claim 1 and those proposed in the closest prior art (i.e. without tellurium). Nor is there any other teaching in the patent from which it could be concluded that the catalyst, rather than some other feature or combination of features, is responsible for the high overall selectivity towards the desired products observed in the examples. It was also not disputed at the oral proceedings that different process conditions can influence the results obtained. Furthermore, the two relevant examples of the patent (i.e. 3 and 6) are carried out within a very narrow

scope of operating conditions, so that there is no reasonable basis for assuming that the observed results would be obtained throughout the entire scope of protection. This is particularly true considering that claim 1 in question covers all possible operating conditions (i.e. it only defines that the temperature is 450°C or lower) and that examples 3 and 6 of the patent seem to indicate that the selectivities towards the different products vary drastically with comparatively small modifications of the operating conditions (these examples differ only in that the temperature is 5°C higher/lower). Finally, it should also be noted that the initial gas mixture in the examples of the patent is different from that used in the examples of D1, which makes it difficult to make a meaningful comparison between the obtained results.

2.2.8 At oral proceedings, the proprietor further argued that the catalyst according to the patent provided a higher ethane conversion than the closest prior art, because the contact residence time in the patent examples was only 0,84 seconds compared to 30 seconds in examples 5 and 9 of D1.

2.2.9 The Board does not agree with this argumentation because there is no evidence that this alleged effect would be achieved for all process conditions and all catalyst compositions covered by the patent, in particular considering that the patent contemplates contact times of up to 100 seconds (see par. [0029]) and that document D1 anticipates a catalyst falling within the scope of claim 1 (claim 8).

2.2.10 In the light of the above considerations, the Board concludes that the invention does not solve the problem stated in the patent or proposed by the proprietor. The

technical problem solved by the invention must therefore be reformulated less ambitiously, as the provision of an alternative catalytic process.

### 2.3 Obviousness of the solution

2.3.1 As indicated above, D1 discloses (see page 3, line 18 and claim 8) six preferred catalysts, with one of them having a formula falling within the scope of claim 1 at issue ( $\text{Mo}_{1,00}\text{V}_{0,50}\text{Nb}_{0,15}\text{Te}_{0,2}\text{Pd}_{0,0002}$ ).

2.3.2 The proprietor argued that it would not be obvious to a person skilled in the art to consider this particular catalyst among the various alternatives, because whilst the invention was intended to provide a process that produced both ethylene and acetic acid, D1 was intended to selectively produce acetic acid. Therefore, the inventive step requirement was met because, even if the only problem solved by the invention was the provision of an alternative, it would not be obvious to the a person skilled in the art to select the tellurium-containing catalyst to solve the underlying technical problem.

2.3.3 The Board does not agree with the proprietor's reasoning, because if the only problem solved by an invention is that of finding an alternative, there is no need to find specific incentives for the skilled person to consider modifications which are taught as alternatives in the cited prior art. In the present case, the tellurium-containing catalyst is not only known from the prior art, but is disclosed as one of the six preferred alternatives in D1. The Board therefore concludes that it would be obvious to the skilled person, when searching for alternative processes, to replace the catalysts in the examples of



D1 with the tellurium-containing catalyst proposed on page 3, line 18 or claim 8 of this document.

2.4 The subject-matter of claim 1 does therefore not involve an inventive step in view of D1 alone.

3. Auxiliary requests 1 and 2 - Admissibility

3.1 The proprietor submitted auxiliary requests 1 and 2 on 28 June 2023 after the notification of the summons to oral proceedings. The admittance of this request is therefore governed by Article 13(2) RPBA, which stipulates that at such late stage amendments to the case shall, in principle, not be taken into account unless exceptional circumstances apply. In addition, the criterion of clear allowability under Article 13(1) RPBA also applies.

3.2 The proprietor argued that the new auxiliary requests involved the deletion of one of the two alternatives contained in the previously pending auxiliary request 1, so that the subject-matter of the invention was not only part of the appeal proceedings but had also been dealt with in the first instance proceedings. The filing of these new requests, as well as the withdrawal of the previous auxiliary requests, was intended to streamline the proceedings and to respond to the preliminary opinion of the Board, as they introduced new limitations with respect to D1. They should be considered as clearly allowable, as they simply reflected technical effects that were part of the application as originally filed and that, in view of the examples in the patent, were achieved in the course of the invention. Auxiliary requests 1 and 2 should therefore be admitted to the proceedings.

- 3.3 The Board disagrees with the proprietor, as none of the reasons given amount to exceptional circumstances which could justify the filing of the requests at this late stage of the proceedings. It is in particular irrelevant that the requests are based on previously defined alternatives, because the deletion of the other options would effectively shift the discussion on inventive step in a non-convergent manner at a late stage. Nor can the filing of the new requests be justified by a change in the subject-matter of the proceedings, since the preliminary opinion of the Board (i.e. that the invention is obvious in view of D1) is based on the objections previously raised by the opponent.
- 3.4 The Board also agrees with the appellant in that the new requests do not fulfill the requirement of clear allowability pursuant to Article 13(1) RPBA. In particular, since the claims are now restricted by defining the scope in terms of several results to be achieved (i.e. conversion of ethane of at least 10%, selectivity to ethylene greater than 75% and selectivity to acetic acid greater than 15%) without clearly defining those aspects which are required to obtain this effect, the new requests would likely give rise to new issues at least under Articles 83 and 84 EPC.
- 3.5 Auxiliary requests 1 and 2 are therefore not admitted into the appeal proceedings.
4. Since none of the requests presented by the proprietor is considered to be admissible and allowable, the Board concludes that the patent should be revoked.

**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:



A. Pinna

L. Li Voti

Decision electronically authenticated