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Datasheet for the decision of 25 January 2024

Case Number: T 1778/21 - 3.3.05

Application Number: 13178810.1

Publication Number: 2664379

IPC: B01D53/94, B01J23/63, B01J35/00, F01N3/035, F01N3/20, F01N13/00

Language of the proceedings: EN

Title of invention:
ZONE COATED CATALYST TO SIMULTANEOUSLY REDUCE NOX AND UNREACTED AMMONIA

Patent Proprietor:
ENGELHARD CORPORATION

Opponents:
Umicore AG & Co. KG
JOHNSON MATTHEY PUBLIC LIMITED COMPANY

Headword:
Zone coated catalyst/ENGELHARD

Relevant legal provisions:
EPC Art. 56, 123(2)
RPBA 2020 Art. 12(2), 12(4), 12(5)

Keyword:

Amendments - added subject-matter (yes)
Admittance of additional experimental data (yes)
Objection sufficiently substantiated (no) - admitted (no)
Inventive step - auxiliary request (yes) - unexpected improvement shown

Decisions cited:

Catchword:

Europäisches Patentamt
European Patent Office
Office européen des brevets

Beschwerdekammern

Boards of Appeal

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Case Number: T 1778/21 - 3.3.05

D E C I S I O N
of Technical Board of Appeal 3.3.05
of 25 January 2024

Appellant: (Patent Proprietor)	ENGELHARD CORPORATION 101 Wood Avenue, P.O. Box 770 Iselin, NJ 08830-0770 (US)
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Appellant: (Opponent 1)	Umicore AG & Co. KG Rodenbacher Chaussee 4 63457 Hanau-Wolfgang (DE)
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Party as of right: (Opponent 2)	JOHNSON MATTHEY PUBLIC LIMITED COMPANY 5th Floor 25 Farringdon Street London EC4A 4AB (GB)
Representative:	Boult Wade Tennant LLP Salisbury Square House 8 Salisbury Square London EC4Y 8AP (GB)
Decision under appeal:	**Interlocutory decision of the Opposition Division of the European Patent Office posted on 27 July 2021 concerning maintenance of the European Patent No. 2664379 in amended form.**

Composition of the Board:

Chairman	E. Bendl
Members:	T. Burkhardt
	S. Fernández de Córdoba

Summary of Facts and Submissions

I. The appeals, by the patent proprietor and by opponent 1, are against the opposition division's decision to maintain European patent No. 2664379 as amended on the basis of the second auxiliary request then on file (present sixth auxiliary request).

II. Of the documents discussed at the opposition stage, the following are relevant to the present decision.

D10 EP 0 393 905 A2

D15 US 5,516,497 A

D16 J. Gieshoff et al., "Advanced Urea SCR Catalysts for Automotive Applications", SAE Technical Paper Series, 2001-01-0514, pp. 1-8; March 2001

III. The opposition division came to a number of conclusions, including the following.

- The main request (patent as granted) did not meet the requirements of Article 123(2) EPC.
- The first auxiliary request did not meet the requirements of Article 123(2) EPC.
- The second auxiliary request (present sixth auxiliary request) met the requirements of the EPC.

IV. Independent claim 1 of the main request reads as follows.

"*1. A catalyst article comprising a substrate comprising an inlet catalytic zone and an outlet catalytic zone, wherein said substrate has an inlet end, an outlet end, a length extending between the*

inlet end to the outlet end, wall elements and a plurality of passages defined by the wall elements;

wherein an SCR catalyst composition is disposed at a concentration of at least 0.0793 g/cm^3 (1.3 g/in^3) on the wall elements from the inlet end toward the outlet end to a length that is less than the substrate's axial length to form the inlet catalytic zone; and

an NH_3 destruction catalyst composition comprising a platinum group metal component dispersed on a refractory metal oxide, wherein the NH_3 destruction catalyst composition is disposed on the wall elements from the outlet end toward the inlet end to a length that is less than the substrate's axial length to form the outlet catalytic zone; and

wherein there is from 0.0035 to 0.35 g/L (0.1 to 10 g/ft^3) of platinum group metal component in the outlet catalytic zone."

V. Compared with claim 1 of the main request, the end of the passage relating to the "SCR catalyst composition" in claim 1 of the **first** auxiliary request has been supplemented by the following feature (emphasis added by the board).

"*... catalytic zone<u>, and wherein the SCR catalyst composition comprises a zeolite</u>;*
and"

VI. Compared with claim 1 of the main request, the end of the passage relating to the "SCR catalyst composition" in claim 1 of the **second** auxiliary request has been supplemented by the following feature (emphasis added by the board).

"*... catalytic zone, and wherein the SCR catalyst composition comprises a zeolite having a pore system interconnected in all three crystallographic dimensions; and*"

VII. Compared with claim 1 of the main request, the concentration of the SCR catalyst composition in claim 1 of the **third** auxiliary request has been replaced by the following (emphasis and deletions added by the board).

"*~~at least 0.0793 g/cm^3 (1.3 g/in^3)~~0.109 to 0.159 g/cm^3 (1.8 to 2.6 g/in^3)*"

VIII. Compared with claim 1 of the third auxiliary request, the concentration of the platinum group metal in the outlet catalytic zone in claim 1 of the **fourth** auxiliary request has been replaced by the following (emphasis and deletions added by the board).

"*~~0.0035 to 0.35 g/L (0.1 to 10 g/ft^3)~~0.0176 to 0.176 g/L (0.5 to 5 g/ft^3)*"

IX. The **fifth** auxiliary request combines the amendments of the second and third auxiliary requests. Moreover, the following feature has been inserted at the end of claim 1.

"*~~.~~, wherein the platinum group metal component is a platinum component.*"

X. The independent claims of the sixth auxiliary request read as follows (differences from claims 1 and 14 as granted underlined or in strikethrough; emphasis added by the board).

"*1. A catalyst article comprising a substrate comprising an inlet catalytic zone and an outlet catalytic zone, wherein said substrate has an inlet end, an outlet end, a length extending between the inlet end to the outlet end, wall elements and a plurality of passages defined by the wall elements;*

wherein an SCR catalyst composition is disposed at a concentration of at least 0.0793 g/cm^3 (1.3 g/in^3) on the wall elements from the inlet end toward the outlet end to a length that is less than the substrate's axial length to form the inlet catalytic zone, and wherein the SCR catalyst composition comprises a zeolite having pores which exhibit a pore diameter of at least 7 Angstroms and are interconnected in three dimensions; and

an NH_3 destruction catalyst composition comprising a platinum group metal component dispersed on a refractory metal oxide, wherein the NH_3 destruction catalyst composition is disposed on the wall elements from the outlet end toward the inlet end to a length that is less than the substrate's axial length to form the outlet catalytic zone; and

wherein there is from 0.0035 to 0.35 g/L (0.1 to 10 g/ft^3) of platinum group metal component in the outlet catalytic zone."

"*~~14~~12. A method for reducing NOx emissions in the exhaust stream produced from an internal combustion engine, the method comprising:*

(a) metering at periodic intervals ammonia or an ammonia precursor into the exhaust stream;

(b) passing the exhaust stream through a substrate comprising an SCR catalyst composition; wherein the substrate has an inlet end, an outlet end, a length extending between the inlet end to the outlet end, wall elements and a plurality of passages defined by the wall elements;

wherein the SCR catalyst composition is disposed at a concentration of at least 0.0793 g/cm^3 (1.3 g/in^3) on the wall elements from the inlet end toward the outlet end to a length that is less than the substrate's axial length to form an inlet zone~~;~~, and wherein the SCR catalyst composition comprises a zeolite having pores which exhibit a pore diameter of at least 7 Angstroms and are interconnected in three dimensions; and

wherein the NH_3 destruction catalyst composition comprises a platinum group metal component dispersed on a refractory metal oxide, wherein the NH_3 destruction catalyst composition is disposed on the wall elements from the outlet end toward the inlet end to a length that is less than the substrate's axial length to form an outlet zone; and

wherein there is from 0.0035 to 0.35 g/L (0.1 to 10 g/ft^3) of platinum group metal component in the outlet zone."

Dependent claims 2 to 11, 13 and 14 relate to specific embodiments.

XI. With its grounds of appeal, the patent proprietor

- presented new experimental data
- re-submitted the main request (patent as granted) and the first auxiliary request
- submitted new second to fifth auxiliary requests

- submitted the former second auxiliary request, which had been maintained by the opposition division, as the sixth auxiliary request

XII. In a communication under Article 15(1) RPBA 2020, the board informed the parties that the appeals would probably be dismissed.

XIII. In response, all the parties withdrew their requests for oral proceedings on the condition that the board did not move away from its preliminary opinion.

XIV. The oral proceedings scheduled for 25 January 2024 were cancelled.

XV. The arguments made by the patent proprietor (appellant 1) during the appeal, where relevant to the present decision, can be summarised as follows.

All the requests met the requirements of the EPC.

XVI. The arguments made by the opponents (appellant 2 and respondent) during the appeal, where relevant to the present decision, can be summarised as follows.

The experimental data submitted by the patent proprietor with its appeal should not be considered.

The main request and first auxiliary request did not meet the requirements of Article 123(2) EPC.

The second to fifth auxiliary requests should not be admitted. They did not meet the requirements of Article 123(2) EPC either.

The subject-matter of the independent claims of the sixth auxiliary request lacked inventive step in view of either of the following:

- D15 (or D10) as the closest prior art in combination with D16
- D16 as the closest prior art in combination with D15 (or D10)

XVII. The patent proprietor (appellant 1) requested that the decision under appeal be set aside and that the oppositions be rejected (main request). In the alternative, it requested that the patent be maintained in amended form on the basis of one of six auxiliary requests filed with its statement setting out the grounds of appeal.

Opponent 1 (appellant 2) requested that the decision under appeal be set aside and that the patent be revoked.

Opponent 2 (party as of right) requested that appellant 1's appeal be dismissed.

Reasons for the Decision

1. Consideration of new experimental data

With its grounds of appeal, the patent proprietor presented new experimental data to show an effect over D15.

In opponent 1's view, these data are not to be admitted. The inventive-step objection starting from D15 had already been raised prior to the oral

proceedings at the opposition stage, and the patent proprietor should have filed this evidence earlier.

This argument is not convincing. While D15 has been present in the proceedings from the beginning, an inventive-step objection was only raised by opponent 1 five months after the summons to oral proceedings (in which another document altogether was considered as the closest prior art). In the case at hand the board considers a period of only two months before the date of oral proceedings for submitting experimental evidence to be rather short.

Under these circumstances, filing the experimental data early in the appeal proceedings appears adequate.

The new experimental data are therefore admitted (Article 12(2) and (4) RPBA 2020).

Main Request

The main request concerns maintenance of the patent as granted.

2. Article 123(2) EPC

Claim 1 of the main request contains the feature that the concentration of the SCR catalyst composition is "*at least 0.0793 g/cm^3 (1.3 g/in^3)*".

According to the patent proprietor, this feature is based on page 13, lines 15 to 18 of the application as originally filed.

This passage states that "*such* SCR catalyst compositions are deposited at a concentration of at least 1.3 g/in^3 to ensure that the desired NOx reduction and particulate removal levels are achieved and to secure adequate durability of the catalyst over extended use" (emphasis added by the board).

It is part of the section "SCR Catalyst Compositions", which starts on page 12, line 5, and the word "such" on page 13, line 5 makes it clear that the expression refers back to the preceding paragraph, which starts on page 12, line 17.

In this preceding passage, the aspects "removal level" and "durability" are already addressed, directly or indirectly. Examples include the following.

- Page 12, line 17 "*sulfur poisoning*"
- Page 12, line 18 "*high level of activity*"
- Page 12, lines 19 to 20 "*adequate movement of the reactant molecules* [...] *and* [...] *product molecules*"
- Page 13, lines 1 to 6 "*It has been found that zeolites which are highly resistant to sulfate poisoning and provide good activity for both the SCR process and the oxidation of ammonia with oxygen, and which retain good activity even when subject to high temperatures, hydrothermal conditions and sulfate poisons, are zeolites which have pores which exhibit a pore diameter of at least about 7 Angstroms and are interconnected in three dimensions.*"
- Page 13, lines 7 to 10 "*the interconnection of pores of at least 7 Angstroms diameter in three dimensions provides for good mobility of sulfate molecules throughout the zeolite structure, thereby permitting the sulfate molecules to be released*

from the catalyst to free a large number of the available adsorbent sites"

Besides the word "such" on page 13, line 15, there is hence also a clear functional relationship between the concentration of the SCR catalyst composition on the one hand and the "*interconnection of pores of at least 7 Angstroms diameter in three dimensions*" (page 13, lines 7 to 8) on the other hand.

By contrast, there is no reason to conclude that the term "such" on page 13, line 15 could refer back to SCR compositions mentioned in the background section.

Nor do the other passages of the application as originally filed disclose the specific concentration range *in combination* with the SCR catalyst composition in general. While the first lines of page 23 in particular disclose an SCR catalyst composition with a concentration in the claimed range, there is no general disclosure of the concentration range, and moreover the concentration on page 23 is disclosed in combination with further features that have not been included in claim 1.

Therefore, inserting the specific concentration range of the SCR catalyst composition into claim 1 while omitting the latter features amounts to an intermediate generalisation.

The fact that the section "SCR Catalyst Compositions" starts on page 12, line 6 with a sentence involving the word "may" is irrelevant, since the concentration of the SCR catalyst composition, the interconnected nature of the pores and their diameter are all subsequently disclosed in combination.

The board therefore shares the opposition division's view that the main request does not meet the requirements of Article 123(2) EPC.

First to fifth auxiliary requests

3. Article 123(2) EPC

The same reasoning also applies to the first to fifth auxiliary requests, the question of the admissibility of the second to fifth auxiliary requests notwithstanding.

While the "interconnected" nature of the pore system has been inserted into claim 1 of the second and fifth auxiliary requests, the minimum pore size of 7 Å has not.

The preferred concentration range of 1.8 to 2.6 g/in^3 in claim 1 of the third and fourth auxiliary requests can also be found in the passage on page 13, lines 15 to 20 as originally filed. As explained above, this passage clearly refers back to the preceding paragraph.

Therefore, the first to fifth auxiliary requests do not meet the requirements of Article 123(2) EPC either.

Sixth auxiliary request

This request corresponds to the new version of the second auxiliary request that was filed at the oral proceedings at the opposition stage, and was maintained by the opposition division.

4. Article 56 EPC

In opponent 1's view, the subject-matter of the independent claims of the sixth auxiliary request does not involve an inventive step (Article 56 EPC).

However, for the reasons set out below, an inventive step is acknowledged.

4.1 **D15** as the closest prior art

4.1.1 The invention relates to a catalyst article and to a method for reducing NOx emissions.

4.1.2 There is agreement that D15 is at least a possible closest prior art.

D15 discloses a catalyst article with a first and a second catalyst zone (claim 1).

The first zone contains an SCR catalyst composition comprising a zeolite with up to about 1 wt.% iron and/or copper.

The second zone contains an NH_3 destruction catalyst composition comprising a zeolite with more than about 1 wt.% Fe and/or Cu.

In all the examples in D15 relating to the first zone, the SCR catalyst composition has a concentration within the claimed range.

Preferably, the zeolite has pores that are interconnected in three dimensions and exhibit a pore diameter of at least 7 Å (claims 9 and 10).

The disclosure of these features has not been disputed.

Since D15 relates to a comparable technical problem to that of the patent in suit, and since it additionally has numerous features in common with the claimed catalyst article, it is a suitable starting point for assessing inventive step.

4.1.3 According to the patent in suit, the problem to be solved is to provide a catalyst article with, simultaneously, efficient NOx conversion and destruction of excess ammonia (paragraph [0044]).

4.1.4 It is proposed that this problem be solved by the catalyst article of claim 1 being characterised by the presence of a platinum group metal in the NH_3 destruction catalyst in a concentration of between 0.1 and 10 g/ft^3.

4.1.5 Since there is no distinguishing feature relating to the SCR catalyst composition, more efficient NOx conversion is not credible.

On the other hand, the figure on page 15 of the patent proprietor's grounds of appeal shows that a platinum group metal in the claimed concentration in the NH_3 destruction catalyst reduces ammonia slip: in fact, the amount of residual NH_3 of the inventive "Cu BEA + Pt SBA" is significantly lower than that of the comparative "Cu-BEA + Fe-BEA" illustrating D15.

4.1.6 The problem is thus reformulated as that of providing a catalyst article with comparable NOx conversion and improved destruction of excess ammonia.

4.1.7 D15 does not contain any incentive to solve the technical problem in the claimed manner.

With regard to **D16**, although an NH_3 destruction catalyst composition with 10 g/ft^3 Pt is disclosed (Figure 9 and the paragraph bridging pages 4 and 5), there is no indication to the skilled person that this feature solves the technical problem posed.

4.1.8 Opponent 1's view is as follows.

(a) It was not credible that reduced ammonia slip was achieved for all platinum group metals and all supports in the NH_3 destruction catalyst composition.

(b) Only the catalyst densities were required by claim 1, not the absolute amounts/lengths of the zones.

(c) The new data submitted by the patent proprietor compared an optimised catalyst article according to the invention with a non-optimised catalyst of the prior art.

(d) The patent itself stated in paragraph [0016] that it was known to add Pt in order to reduce the light-off temperature for NH_3.

However, these arguments (items (a) to (d)) are neither convincing nor supported by evidence.

Furthermore, with regard to (b), D16 likewise merely indicates the density of Pt in the NH_3 destruction catalyst composition.

With regard to (d), however, the patent in suit goes on to state that, previously, the addition of Pt had resulted in the undesirable oxidation of NH_3 to form NOx. Paragraph [0045] of the patent in suit indicates

that this problem is avoided by the invention because of the limited Pt concentration.

4.1.9 Therefore, the combination of D15 with D16 does not render the subject-matter of claim 1 obvious.

4.1.10 Analogous reasoning applies to method claim 12 and dependent claims 2 to 11, 13 and 14.

4.2 **D16** as the closest prior art

Opponent 1 acknowledged that:
- the concentration of the SCR catalyst and
- the deposition of the SCR catalyst and the NH_3 destruction catalyst on a single substrate

were not disclosed in D16; however, its view was that these features related to partial problems and could not justify an inventive step.

However, in addition to these distinguishing features, opponent 1 has not indicated where D16 discloses the following:
- the interconnected nature in three dimensions and
- the minimum diameter of at least 7 Å

of the pores of the zeolite in the SCR catalyst.

While D16 relates to the same technical field as the patent in suit, there are thus significantly more distinguishing features than in D15. The board therefore shares the opposition division's view that D16 does not constitute the closest prior art.

This issue notwithstanding, opponent 1 has failed to explain why the skilled person, when starting from D16,

would choose a zeolite with these properties in the SCR catalyst composition.

4.3 **D10** as the closest prior art

The objection starting from D10 has not been substantiated. It was merely found that D10's teaching was similar to that of D15, without indicating any specific relevant passages. This objection is therefore disregarded (Article 12(5) RPBA 2020).

Order

For these reasons it is decided that:

The appeals are dismissed.

The Registrar: The Chairman:

C. Vodz E. Bendl

Decision electronically authenticated