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Datasheet for the decision of 9 November 2022

Case Number: T 3116/19 - 3.3.06

Application Number: 11818136.1

Publication Number: 2606971

IPC: B01J35/10, B01D53/94, B01J23/63, F01N3/28

Language of the proceedings: EN

Title of invention:
Oxidation catalyst suitable for combustion of light oil component

Patent Proprietor:
Mitsui Mining and Smelting Co., Ltd.

Opponent:
Umicore AG & Co. KG

Headword:
Combustion of light oil/MITSUI

Relevant legal provisions:
EPC Art. 100(a), 56

Keyword:
Inventive step - (yes)

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It can be changed at any time and without notice

Decisions cited:

Catchword:

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Chambres de recours

Boards of Appeal of the
European Patent Office
Richard-Reitzner-Allee 8
85540 Haar
GERMANY
Tel. +49 (0)89 2399-0
Fax +49 (0)89 2399-4465

Case Number: T 3116/19 - 3.3.06

D E C I S I O N
of Technical Board of Appeal 3.3.06
of 9 November 2022

Appellant: (Opponent)	Umicore AG & Co. KG Rodenbacher Chaussee 4 63457 Hanau-Wolfgang (DE)
Representative:	Vossius & Partner Patentanwälte Rechtsanwälte mbB P.O. Box 86 07 67 81634 München (DE)
Respondent: (Patent Proprietor)	Mitsui Mining and Smelting Co., Ltd. 1-11-1 Osaki Shinagawa-ku Tokyo 141-8584 (JP)
Representative:	Dossmann, Gérard Casalonga & Partners Bayerstrasse 71-73 80335 München (DE)
Decision under appeal:	**Decision of the Opposition Division of the European Patent Office posted on 21 October 2019 rejecting the opposition filed against European patent No. 2606971 pursuant to Article 101(2) EPC.**

Composition of the Board:

Chairman	J.-M. Schwaller
Members:	L. Li Voti
	C. Brandt

Summary of Facts and Submissions

I. The opponent's appeal is against the decision of the opposition division to reject the opposition against European patent no. 2606971 granted with the following claims:

"*1. Use of an oxidation catalyst for combustion of a light oil component, characterized in that the catalyst comprises an alumina porous body whose pore size distribution profile, as determined by means of a mercury porosimeter, has a peak falling within a range of 30 to 55 nm, and a noble metal supported on the surface of the alumina porous body and/or on the inner walls of pores of the alumina porous body, the alumina porous body being an La-stabilized alumina porous body which has a mass ratio Al_2O_3/La_2O_3 ranging from 99/1 to 95/5.*

2. Use according to claim 1, wherein the noble metal is at least one species selected from among Pt, Pd, and Rh.

3. Use of an oxidation catalyst product for combustion of a light oil component, characterized in that the catalyst product comprises a catalyst support made of a ceramic or metallic material, and an oxidation catalyst as recited in claim 1 or 2, the oxidation catalyst being supported on the catalyst support.

4. Use according to claim 1, 2 or 3, characterized in that the oxidation catalyst is accommodated in an exhaust gas passage of a diesel engine together with a

diesel particulate filter so as to be located upstream of the diesel particulate filter.

5. An oxidation catalyst for combustion of a light oil component, characterized in that the catalyst comprises an alumina porous body whose pore size distribution profile, as determined by means of a mercury porosimeter, has a peak falling within a range of 30 to 55 nm, and a noble metal supported on the surface of the alumina porous body and/or on the inner walls of pores of the alumina porous body, the alumina porous body being an La-stabilized alumina porous body which has a mass ratio Al_2O_3/La_2O_3 ranging from 99/1 to 95/5.

6. An oxidation catalyst for combustion of a light oil component according to claim 5, wherein the noble metal is at least one species selected from among Pt, Pd, and Rh.

7. An oxidation catalyst product for combustion of a light oil component, characterized in that the catalyst product comprises a catalyst support made of a ceramic or metallic material, and an oxidation catalyst as recited in claim 5 or 6, the oxidation catalyst being supported on the catalyst support."

II. With its statement of grounds of appeal, the appellant cited documents **D1** (EP 1020223 A2), **D2** (JP 2004-290827 A) and **D3** ("*Stabilization of alumina by addition of lanthanum*" by B. Beguin et al., Appl. Catal. 75(1), pages 119-132) and argued that the claimed subject-matter lacked an inventive step. As an auxiliary measure, it requested oral proceedings.

III. With its reply the respondent (also patent proprietor) contested these findings.

IV. In response to the summons to oral proceedings, also exposing the board's provisional opinion, the appellant withdrew his request for oral proceedings and stated that he will not attend the latter. The parties were then notified that oral proceedings had been cancelled.

V. The parties' requests as appearing from the file are the following:

The appellant/opponent requests that the decision under appeal be set aside and the patent be revoked.

The respondent/patent proprietor requests that the appeal be dismissed, and as an auxiliary measure that the patent be maintained in amended form on the basis of one of auxiliary requests 1 and 2 filed with letter of 12 February 2019.

Reasons for the Decision

Main request - patent as granted

1. Inventive step - claim 5

Since the appellant did not reply to the provisional opinion sent with the summons, the board does not see any reason to depart from said opinion, which in essence was as follows.

1.1 The present invention (paragraph [0001] of the patent) relates to an oxidation catalyst (hereinafter a "DOC") to be accommodated in an exhaust gas passage of a diesel engine upstream a particulate filter (hereinafter a "DPF"), and which realises combustion at a relatively low temperature of a light oil supplied in upon regeneration of the DPF.

Claim 5 at issue concerns the oxidation catalyst for combustion of said light oil, which comprises an alumina porous body having a specified pore size distribution profile and a noble metal supported thereon.

As explained in paragraphs [0005], [0006] and [0008] of the patent, the relatively low combustion temperature at an early stage of a conventional DOC tends to increase after long-term use (see Table 1 of the patent). An object of the present invention is thus to provide a DOC which after long-term use is still suitable for combustion at a relatively low temperature of a light oil supplied upon regeneration of a DPF, and which exhibits excellent thermal resistance and durability.

1.2 In the appellant's view the closest prior art is represented by document D1, whilst the respondent considers it to be represented by D2.

1.2.1 In fact, D1 (paragraph [0003]) relates to a three-way catalyst for purifying exhaust gases from conventional engines through simultaneous reduction/oxidation of carbon monoxide, hydrogen, hydrocarbons and nitrogen oxides. One object of D1 (paragraph [0028]) is the provision of a catalyst excellent in exhaust gas purifying ability and in particular in suppressing grain growth of a noble metal which occurs in a high temperature exhaust gas, thus reducing its catalytic activity on the oxidation-reduction process (paragraph [0023]) and being excellent in high temperature durability, NO_x removal performance and resistance against sulfur poisoning.

D1 thus provides inter alia excellent thermal resistance of a catalyst suitable for combustion of hydrocarbons and thus of a light oil component.

1.2.2 D2 (reference is made in the following to the English translation D2a) relates (paragraphs [0008] and [0009]) to an oxidation catalyst that can be arranged upstream from a catalysed diesel particulate filter to exert satisfactory light oil oxidation and burning performance even in a low temperature region of the exhaust gas without using heating means and that maintains the oxidation performance for a long time and is excellent in heat resistance and durability.

1.2.3 In the board's view, D2 - also cited as background art in paragraph [0006] of the patent - deals with a technical problem similar to that of the patent in suit and thus, in accordance with the contested decision, represents the best starting point for the evaluation of the inventive step.

1.2.4 In the board's view, the closest prior art to be chosen for the evaluation of inventive step is represented by the catalyst disclosed in example 1 of document D2, which comprises Pt supported on an alumina porous body composed of a mixture of two γ-aluminas having different specific surface area and a γ-alumina doped with La_2O_3 in a weight ratio of alumina to La_2O_3 of 98.4 to 1.6. This catalyst differs from that of claim 5 at issue only in that its pore size distribution profile is not disclosed.

1.3 Table 1 of the patent in suit shows that a catalyst as claimed (examples 4 to 6) and having a pore size distribution profile with a peak falling within a range of 30 to 55 nm, a mass ratio of θ-Al_2O_3 to La_2O_3 of 96

to 4 and a specific surface area of 150 m^2/g, provides a lower ignition temperature and a minor increase of this temperature after treatment at 750°C for 100 hours than similar catalysts (comparative example and examples 1 to 3) having a pore size distribution profile with a peak lower than 30 nm, i.e. outside the limits of claim 5.

Even though these examples are not directly comparable with the catalyst of D2/example 1, it is noted that the patent (paragraphs [0005] and [0006]) already identifies D2 as background art and affirms in paragraph [0008] that the claimed invention provides an improvement after long-term use, which effect is convincingly shown in the examples of the patent with an increase of the ignition temperature (from 182°C to 190-196°C) of less than 10% after 100 hours. Instead, the ignition temperature increase of the catalyst of example 1 of D2 after 100 hours is of more than 30% (from 182°C to 250°C - see tables 1 and 3).

There is thus no reason to assume that the improvement shown in the examples of the patent in suit is not due to the selection of a particular pore size distribution profile and, in the absence of evidence to the contrary, that such an improvement would not be obtainable across the entire scope of claim 5.

The board thus accepts that the technical problem successfully solved by the subject-matter of claim 5 be formulated as the provision of an improved DOC which, even after long-term use, is suitable for combustion at a relatively low temperature of a light oil component supplied upon regeneration of a DPF, and which exhibits excellent thermal resistance and durability.

1.4 As to the question whether the solution proposed in claim 5 was obvious to the person skilled in the art, the board notes that D2 does not contain any particular suggestion of how to optimise the pore size distribution of the alumina support in order to further improve the therein disclosed oxidation catalyst.

1.4.1 In the board's view, the skilled person would also not have consulted document D1, as the latter does not relate to the same technical problem as the patent in suit and concerns a three-way catalyst for the purification of exhaust gases, not a catalyst supposed to be arranged upstream a catalysed diesel particulate filter as in D2, since three-way catalyst are primarily supposed to purify the exhaust gases from gasoline engines.

1.4.2 And even if the skilled person would have taken into consideration the teaching of D1, he would not have considered the pore size distribution profile of a comparative support, such as the one of comparative example 2-2 calcined at 1200°C, which is the only alumina porous body of D1 having a pore size distribution profile having a peak (40 nm) in accordance with the requirements of attacked claim 5. The skilled person would rather have chosen one of the catalysts illustrating the invention of D1, such as those of examples 8-1 to 8-4, based on carriers 2-8 or 2-12, having improved heat durability with respect to the comparative ones, and which have a pore size distribution profile (peak lower than 30 nm) outside the limits of claim 5 at issue (see Tables 3 and 4 of D1).

1.4.3 It follows from the above considerations that even the hypothetical combination of documents D2 and D1 could

not lead to the claimed subject-matter without the use of hindsight, with the consequence that the thus claimed subject-matter involves an inventive step over the combination of documents D2 and D1.

1.5 Considering for the sake of the argument (in the appellant's favour) that **D1**, in particular the catalyst having as a carrier that of comparative example 2-2 calcined at 1200°C, represents the closest prior art, the technical problem underlying the invention would have still to be formulated starting from the problem described in the contested patent (see case Law of the Boards of Appeal of the EPO, 10th edition 2022, I.D. 4.2.2) and not, as suggested by the appellant, as the provision of an oxidation catalyst having a more long-term stable aluminium oxide surface.

Thus, as exposed above, the technical problem convincingly solved by the subject-matter of claim 5 would be the provision of an improved DOC which, even after long-term use, is suitable for combustion at a relatively low temperature of a light oil component supplied upon regeneration of a DPF, and which exhibits excellent thermal resistance and durability.

1.5.1 Considering that the alumina porous body of said comparative example 2-2 differs from that of claim 5 at issue in that the weight ratio of alumina to La_2O_3 is of 92.6 to 7.4, and so is outside the limits of claim 1 at issue, and moreover has not a good heat durability, in the board's view, the skilled person faced with the technical problem posed would not have modified the Al_2O_3 to La_2O_3 mass ratio of such a carrier, thereby increasing the lanthanum oxide content as suggested for example in D2 (paragraph [0016]) or D3 (Table 1) in order to stabilise the alumina structure, but he would

have rather selected one of the preferred catalysts disclosed in D1 (examples 8-1 to 8-4, based on the carriers of examples 2-8 or 2-12) having an improved heat durability and so, a pore size distribution profile (with a peak lower than 30 nm, the highest peak being that of carrier 2-9 (27.2 nm)) which is not in accordance with the requirements of claim 5 at issue.

1.5.2 In the board's view, even if one of the latter examples would have been be selected as starting point for the evaluation of inventive step, the skilled person would not have found any motivation in the teaching of this document to adapt the pore size distribution profile and the alumina/La_2O_3 mass ratio to values within the limits of claim 5 at issue for solving the technical problem posed, with the consequence that the subject-matter of claim 5 involves an inventive step also starting from document D1.

1.6 For the same reasons, also dependent claim 6 as well as claim 7 directed to an oxidation catalyst product comprising the catalyst of claims 5 or 6 and a catalyst support made of a ceramic or metallic material, and claims 1 to 4 directed to the use of the catalyst of claim 5 or 6 or of the catalyst product of claim 7 for combustion of a light oil component, involve an inventive step in the sense of Article 56 EPC.

2. It follows from the above considerations that none of the objections raised by the appellant prejudices the maintenance of the patent as granted, with the consequence that its appeal fails.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

A. Pinna J.-M. Schwaller

Decision electronically authenticated