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**Datasheet for the decision
of 17 September 2007**

Case Number: T 0810/04 - 3.3.05

Application Number: 98939329.3

Publication Number: 1027154

IPC: B01D 53/50

Language of the proceedings: EN

Title of invention:

SO_x additive systems based upon use of multiple particle species

Applicant:

Intercat, Inc.

Opponent:

-

Headword:

SO_x additive systems/INTERCAT

Relevant legal provisions:

EPC Art. 84, 54, 56

Keyword:

"Clarity (yes)"

"Novelty (yes)"

"Inventive step: remittal to first instance"

Decisions cited:

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Catchword:

-



Case Number: T 0810/04 - 3.3.05

D E C I S I O N
of the Technical Board of Appeal 3.3.05
of 17 September 2007

Appellant: Intercat, Inc.
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Decision under appeal: Decision of the Examining Division of the
European Patent Office posted 13 February 2004
refusing European application No. 98939329.3
pursuant to Article 97(1) EPC.

Composition of the Board:

Chairman: E. Waeckerlin
Members: J.-M. Schwaller
H. Preglau

Summary of Facts and Submissions

I. The appeal was lodged against the decision of the examining division to refuse the European patent application No. 98939329.3. The decision was based on the set of amended claims 1-24 filed with a letter dated 12.08.2002.

II. The contested decision can be summarized as follows:

Examples 6-8 of the present application are in contradiction with claim 1, because the latter states that the binder contains no more than about 10 weight percent aluminum hydroxide and no more than about 10 weight percent of alumina (Al_2O_3), while on the other hand the $\text{SO}_2 \rightarrow \text{SO}_3$ oxidant/binder systems of Examples 6 and 7 contain 41 and 37 weight % alumina, respectively (values calculated by the examining division), and the system of Example 8 is pure alumina impregnated with 850 ppm of platinum. This contradiction with Examples 6-8 renders the wording of claim 1 unclear.

The wording of claims 9, 10 and 12 is unclear, because the feature "*the SO_3 adsorbent component further comprises a $\text{SO}_2 \rightarrow \text{SO}_3$ oxidation catalyst*" is in contradiction with what is claimed in claim 1, namely that "*the SO_3 adsorbent component is physically separate and distinct from the $\text{SO}_2 \rightarrow \text{SO}_3$ oxidation catalyst*".

Claim 1 lacks novelty over D1 (EP-A-0278535) because, due to the lack of clarity of claim 1, the feature that the oxidation catalyst binder contains no more than about 10 weight percent alumina (Al_2O_3) has to be disregarded and thus, Example 8 - described as a

"representative SO₂ → SO₃ Oxidant/Binder System" at page 51, line 1 of the present application - is exactly the oxidant/binder system anticipated by D1.

The examining division furthermore mentioned that D1 already suggested the idea of having the oxidation component and the adsorbent component on two distinct particles in the composition.

- III. With the grounds of appeal, the appellant filed two sets of amended claims as main and auxiliary requests, respectively, as well as several amended pages of the description.
- IV. In a communication dated 17 July 2007, the board questioned the clarity and the novelty of claim 1 of both requests.

As far as clarity was concerned, the subject-matter of the respective claims 1 was regarded as being in contradiction with the content of the description, specifically with Example 8. Claim 1 was furthermore considered unclear because the binder of the SO₂ → SO₃ oxidation catalyst component was defined as being "*made from*" a material selected from a group of various metal-containing compounds, and this cast doubt on whether the binder actually comprised said material as such, or whether the said material was only a precursor of the binder, in which case the binder could have a composition in the final oxidation catalyst different from that of its precursor.

The clarity of the feature "a metal oxide made from a metal-containing compound" selected from a group of various compounds (see claims 1) was also questioned. The novelty of the subject-matter of claim 1 of both the main and auxiliary requests was questioned in the light of the disclosure of D1.

V. With its reply dated 6 August 2007, the appellant withdrew the main and auxiliary requests on file and submitted three new sets of amended claims, respectively as a main, 1st and 2nd auxiliary request. Amended pages of description accompanied each of these sets of claims.

VI. During the oral proceedings, which took place on 17 September 2007, the appellant withdrew all previous requests and submitted, as main request, a unique set of amended claims 1-21. Amended pages 9, 9a, 51 and 52 of the description were also submitted.

Claim 1 reads:

"1. A method of oxidizing SO₂ to SO₃, followed by absorbing said SO₃ formed by the oxidation of SO₂, said method comprising:

(a) oxidizing SO₂ to SO₃ and (b) absorbing said SO₃ formed by the oxidation of SO₂ with first and second physically distinct particle species, wherein said first particle species includes an SO₂ → SO₃ oxidation catalyst component and carries out a primary function of oxidizing sulfur dioxide to sulfur trioxide and said second particle species is physically separate and distinct from the first particle species and carries out a function of absorbing said SO₃ produced by the oxidation of said SO₂ to SO₃; wherein:

said oxidation catalyst component in the form of a particle that comprises: (i) a sulfur SO_2 - SO_3 oxidation catalyst comprised of a metal selected from the group consisting of cerium, vanadium, platinum, palladium, rhodium, molybdenum, tungsten, copper, chromium, nickel, iridium, manganese, cobalt, iron, ytterbium, and uranium; and (ii) a binder selected from the group of metal-containing compounds consisting of calcium aluminate, aluminium silicate, aluminium titanate, zinc titanate, aluminium zirconate, magnesium aluminate, magnesia, alumina (Al_2O_3), aluminum hydroxide, an aluminum-containing metal oxide compound (other than alumina (Al_2O_3)), clay, zirconia, titania, clay/phosphate material and bastnaesite and which contains no more than 10 weight percent aluminum hydroxide and no more than 10 weight percent alumina (Al_2O_3); and said absorbent component is in the form of a second particle that comprises a metal oxide made from a metal-containing compound selected from the group consisting of hydrotalcite, magnesia, magnesium acetate, magnesium nitrate, magnesium chloride, magnesium hydroxide, magnesium carbonate, magnesium formate, magnesium aluminate, hydrous magnesium silicate, magnesium calcium silicate, calcium silicate, alumina, calcium oxide, and calcium aluminate."

VII. The appellant submitted in particular the following arguments:

Regarding the inventive step issue and starting from D1 as the closest prior art, the problem to be solved was to provide a SO_x additive system having physically separate and distinct particles of $SO_2 \rightarrow SO_3$ catalyst and SO_3 absorbent, in which system the amount of alumina

was reduced or eliminated while the high activity and absorption rates achieved with alumina were maintained. The subject-matter of claim 1 was distinguished from D1 - which uses alumina as a binder - in that the type of material was a different one. The binder materials as defined in claim 1 being not conventionally known for the present use, it was not obvious to replace the alumina binder of D1 therewith.

The oxidant/binder systems described in Examples 6 and 7 were employed in the TGA measurements described at pages 42-45 of the description. For the sake of clarity, both examples should be maintained in the application, in which case they ought to be identified as relating to "standard oxidants".

VIII. The appellant requested that the decision under appeal be set aside and that a patent be granted in the following version:

Claims: 1-21 filed during the oral proceedings,
Description: pages 1-8, 10-50, 53-57 as published in
WO 99/11372 and pages 9, 9a, 51, 52 as filed during the
oral proceedings (main request),

or to set aside the decision under appeal and remit the case to the first instance for further prosecution on the basis of the above-mentioned documents (auxiliary request).

Reasons for the Decision

1. *Allowability of the amendments under Article 123(2) EPC*

Claims 1-21 of the present request have the following basis in the international application published under the PCT as WO 99/11372:

- claim 1: claim 26 and page 5, lines 8-19 of WO 99/11372
- claims 2 to 13: claims 27 to 33, 36, 38, 40 to 42, respectively
- claim 14: claim 43
- claim 15: claim 44
- claims 16 to 18: claims 46 to 48, respectively
- claims 19 to 21: claims 49 and 50, 51, 52.

The requirements of Article 123(2) EPC are therefore fulfilled.

2. *Clarity*

The objections of lack of clarity raised in the contested decision and in the board's communication no longer apply to the present set of claims for the following reasons:

- The claims 9, 10 and 12 objected to as unclear in the contested decision have been deleted.
- In claim 1 of the present request the binder is no longer defined as being "made from" but as being "selected from" a group of metal-containing compounds.

- Example 8 has been deleted from the description and Examples 6 and 7, respectively, identified as relating to "*standard oxidants for use in measuring the adsorption rate of SO_x absorbants in the TGA measurements described above*". The discrepancy between these Examples and the subject-matter of claim 1 thus no longer exists.

3. Novelty over D1

The objections of lack of novelty raised in the contested decision and in the board's communication no longer apply for the following reasons:

- 3.1 As mentioned above, the discrepancy between Example 8 and claim 1 has been remedied by deleting Example 8, thus the objection based thereon in the contested decision no longer applies.
- 3.2 D1 (page 2, lines 1-14) concerns a catalyst composition for converting hydrocarbon feeds containing a catalytically active material, a sulphur oxides binding material and a matrix material. During the catalytic conversion, the formation of coke partially deactivates the catalyst. During regeneration thereof, the coke is combusted with simultaneous formation of sulphur oxides, the emissions of which into the atmosphere may be controlled by adding a sulphur oxides absorbent.

In the "second preferred embodiment" of D1 (see page 6, lines 3-26) - which has the advantage that the amount of sulphur oxides binding material to be added can simply be adapted to the hydrocarbon feed to be

processed - the catalyst is composed of particles a) comprising a catalytically active material embedded in a matrix material and particles b) of sulphur oxides binding material comprising an anionic clay embedded or not in a matrix material. Very suitable is a physical mixture containing:

a) catalytically active particles comprising 5 to 80, preferably 10 to 40 wt. % of catalytically active material; 0 to 60, preferably 20 to 50 wt. % of non-anionic clay, and 5 to 90, preferably 10 to 30 wt. % of matrix material; and

b) particles of sulphur oxides binding material comprising 1 to 99, preferably 20 to 80 and more particularly 40 to 70 wt. % of anionic clay, 0 to 70 wt. % of non-anionic clay and 1 to 99, preferably 5 to 60, more particularly 8 to 20 wt. % of matrix material.

A preferred matrix material (i.e. a binder) to be used in both types of particles a) and b) is silica, silica-alumina or alumina (D1, page 6, lines 22-23).

According to the Examples of D1:

- the particles b) may comprise a hydrotalcite or a hydrotalcite-like clay as the anionic clay embedded in a matrix of kaolin clay and alumina

- the particles a) may contain platinum as oxidation promoter; as indicated on page 4, lines 36-45, platinum acts as a promoter for the conversion of the undesirable SO₂ formed in the regeneration of the catalyst, whereby SO₂ is oxidized into SO₃.

3.3 In Example 2 of D1, specific physical mixtures of catalyst compositions are described. They consist of:

- a) 95 wt.% of "KMC-25P", a standard FCC catalyst in particles form containing 5 ppm of platinum oxidation promoter, and
- b) 5 wt.% of particles consisting of 60 wt.% anionic clay (in Examples 2-1 and 2-2 the anionic clay is of the hydrotalcite type) and 40 wt.% of a matrix in which the clay is embedded, said matrix consisting of 75 wt.% kaolin clay and 25 wt.% alumina derived from aluminium chlorohydrol.

D1 does not reveal the composition of the "KMC-25P" catalyst particles a), except its platinum content. However, as indicated in the description, a physical mixture is very suitable; this mixture contains a) catalytically active particles and b) particles of sulphur oxides binding material, whereby the particles a) comprise preferably 10 to 30 wt. % of a matrix material (page 6, lines 11-14), the preferred matrix (i.e. a binder) material being silica, silica-alumina or alumina (page 6, lines 22-23).

The above physical mixture was furthermore tested to determine its sulphur binding properties using the testing procedure described in D1 on page 8, lines 54 ff., which procedure implicitly includes the oxidation of SO₂ to SO₃.

- 3.4 Since the list of binders quoted under item (ii) of claim 1 of the present request no longer contains silica and since the binder therein defined contains not more than 10 wt. % alumina (Al₂O₃), the subject-matter of claim 1 (and thus also of its dependent claims 2-21) is no longer anticipated by the disclosure

of D1. These claims therefore fulfil the requirements of Article 54 EPC.

4. *Inventive step*

The board notes that, although the issue of inventive step was briefly addressed in the decision under appeal, no thorough assessment based on the problem-solution approach was made by the examining division. Moreover, the claimed subject-matter was restricted during the course of the appeal procedure, and the wording of the amended claims 1 to 21 was submitted for the first time only during the oral proceedings before the board. Under these circumstances, the board has decided not to investigate the substantive question of inventive step but to exercise its power conferred by Article 111(1) EPC and remit the case to the examining division for further prosecution, thus giving the appellant the opportunity to have the issue of inventive step examined by two instances.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside
2. The case is remitted to the first instance for further prosecution

The Registrar:

The Chairman:

C. Vodz

E. Wäckerlin