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Datasheet for the decision of 12 January 2007

Case Number: T 0884/02 - 3.3.05

Application Number: 97949485.3

Publication Number: 0876295

IPC: C01B 13/34

Language of the proceedings: EN

Title of invention:
Nanostructured oxides and hydroxides and methods of synthesis therefor

Applicants
The University of Connecticut, et al

Opponent:
-

Headword:
Nanostructured oxides/UNIVERSITY OF CONNECTICUT

Relevant legal provisions:
EPC Art. 82, 84

Keyword:
"Clarity: yes (amended claims)"
"Unity: yes (amended claims)"

Decisions cited:
-

Catchword:
-

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Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 0884/02 - 3.3.05

D E C I S I O N
of the Technical Board of Appeal 3.3.05
of 12 January 2007

Appellants: The University of Connecticut et al.
The Graduate Center
438 Whitney Road
Storrs
Connecticut 06268 (US)

Representative: Stenger, Watzke & Ring
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Decision under appeal: **Decision of the Examining Division of the European Patent Office posted 3 May 2002 refusing European application No. 97949485.3 pursuant to Article 97(1) EPC.**

Composition of the Board:

Chairman: M. Eberhard
Members: B. Czech
S. Hoffmann

Summary of Facts and Submissions

I. The appeal is from the decision of the examining division refusing European patent application No. 97 949 485.3, which is based on the international application PCT/US97/21141 published under the number WO 98/22387 and containing 67 claims.

II. The claims of the application were substantially amended and reduced in number during substantive examination. The refusal of the application by the examining division was based on a set of 10 claims filed with letter dated 31 May 2001. The reason for the decision was that there was a lack of unity between different inventions defined in the sole process claim 1 and in three groups of product claims, respectively.

III. In their statement of grounds of appeal dated 15 August 2002, the appellants requested that the appeal be set aside and a patent be granted on the basis of a new set of amended claims, submitted together with the said statement.

IV. In the annex to the summons to oral proceedings, the board raised objections under Articles 123(2) and 84 EPC against the amended claims filed by the appellants. More particularly, the board expressly objected to the clarity of the expression "*co-atomizing the aqueous reactant solution into the aqueous starting solution*" contained in claim 1 of the said set. The board, referring to D1 = GB-A-2 066 963 and to the prior art discussed on page 6, second paragraph, of the present application, also questioned whether the new claims met

the requirement of unity of invention. The board however indicated that the prior art cited in the search report did not appear to justify objections concerning novelty or inventive step.

V. With their letter dated 29 December 2006, the appellants filed two further sets of claims as auxiliary requests I and II.

VI. During the oral proceedings which took place on 12 January 2007, the appellants filed a fresh set of amended claims as sole ("main") request, replacing all the previously filed requests.

Independent claims 1 and 11 according to this last request read as follows. They differ from independent claims 1 and 14 of the published PCT application in that they contain the additional features **emphasised** by the board and in that in one occurrence "into" was replaced by "and" (amendment also emphasised by the board).

1. A method for the synthesis of nanostructured **metal** oxides and hydroxides **having a grain diameter of 1 to 100 nanometers**, comprising:
providing an aqueous starting solution and an aqueous reactant solution, **wherein at least one of the aqueous starting solution or the aqueous reactant solution comprises at least one water-soluble salt precursor of the nanostructured metal oxide or hydroxide;**
co-atomizing the aqueous reactant solution **and** ~~into~~ the aqueous starting solution **into a reaction vessel containing the aqueous starting solution**, thereby precipitating **in a suspension** a nanostructured **metal**

oxide or hydroxide powder from the mixture of the aqueous starting and reactant solutions;

heat treating **the suspension of** the nanostructured **metal** oxide or hydroxide powder to produce a heat-treated nanostructured **metal** oxide or hydroxide; and

ultrasonicating **a suspension of** the heat-treated nanostructured **metal** oxide or hydroxide.

11. A method for the synthesis of nanostructured **metal** oxides and hydroxides **having a grain diameter of 1 to 100 nanometers**, comprising the sequential steps of:

providing an aqueous starting solution and an aqueous reactant solution, **wherein at least one of the aqueous starting solution or the aqueous reactant solution comprises at least one water-soluble salt precursor of the nanostructured metal oxide or hydroxide;**

co-atomizing the aqueous reactant solution **and** ~~into~~ the aqueous starting solution **into a reaction vessel containing the aqueous starting solution**, thereby precipitating **in a suspension** a nanostructured **metal** oxide or hydroxide powder from the mixture of the aqueous starting and reactant solutions;

ultrasonicating **a suspension of** the nanostructured **metal** oxide or hydroxide precipitate; and

heat treating the ultrasonicated **metal** nanostructured oxide or hydroxide.

VII. The arguments of the appellants can be summarised as follows:

All of the amendments carried out in the claims found a basis in the PCT application. Since product claims were no longer present, unity of invention was no longer at issue. A skilled person reading the amended claims 1

and 11 in the light of the application would understand that these claims required that to precipitate the metal oxide or hydroxide, the two aqueous solutions must be atomised in such a manner that they meet and mix before reaching the starting solution in the vessel, as shown e.g. in Figure 2.

VIII. The appellants requested that the contested decision be set aside and that the patent be granted on the basis of claims 1 to 12 filed as main request during the oral proceedings.

Reasons for the Decision

1. Amended claims 1 to 12 are based on the application and thus comply with the requirements of Article 123(2) EPC.

1.1 A basis for amended independent claim 1 can be found in claims 1 and 2, in Figure 2, in examples 1 and 2, and on page 2, lines 2 to 3; page 6, lines 17 to 28; page 7, lines 1 to 7; page 13, lines 1 to 3, lines 13 to 23 and lines 28 to 29; and page 14, lines 1 to 9 of the published PCT application.

1.2 Dependent claims 2 to 10 find their basis in claims 3 to 11 of the published PCT application.

1.3 A basis for amended independent claim 11 and claim 12 dependent thereon can be found in claims 14 and 15, in example 3, in Figure 2, and on page 2, lines 2 to 3; page 6, lines 17 to 28; page 7, lines 1 to 7; page 13, lines 1 to 3 and lines 13 to 23 of the published PCT application.

2. As acknowledged by the appellants during the oral proceedings, the term "*co-atomisation*" does not, as such, express that the two atomised aqueous solutions have to meet and mix in the atomised state. However, an alternative wherein the starting solution would be atomised into a vessel containing the starting solution without meeting the atomised reactant solution makes little or no technical sense. Claim 1 in its amended wording will thus be understood by the skilled person as implicitly meaning that the two aqueous solutions atomised into the vessel containing the starting solution meet and mix in atomised form to form a precipitate suspension in the aqueous starting solution. This understanding of claim 1 is in accordance with all those parts of the description and drawings which relate to the process step involving atomisation, i.e. Figure 2, examples 1 to 3, and page 13, lines 1 to 3 and lines 13 to 23.

3. Claims 1 and 11 cover various processes for obtaining various nanostructured metal oxides or hydroxides by precipitation. However, these processes all comprise the co-atomisation of two aqueous reactant solutions, a heating step and an ultrasonicating step. As will appear from the following paragraphs, this combination of features, common to all the claimed processes, is neither known from nor suggested by the prior art. Hence, there is unity of invention.

4. A process for the precipitation of metal oxides or hydroxides involving a co-atomisation as required by claim 1 is not disclosed in the prior art cited in the

search report. The board thus concludes that the subject-matter of claims 1 to 12 is novel.

5. The claimed process permits the preparation of various kinds of nanostructured metal oxides or hydroxides. It was not contested by the appellants that processes for obtaining nanostructured metal oxides were known. For instance, D1 discloses the preparation of alumina particles having a mean size of less than 20nm by a method comprising mixing alumina with a non-aqueous organic liquid, subjecting the mixture to ultrasonication, followed by a sedimentation step which provides size grading, see claims 1 and 3 in combination with page 2, lines 10 to 20. Moreover, the present application itself mentions known techniques for synthesising nanostructured zirconia which involve inert gas condensation, chemical vapour condensation or sol-gel synthesis and which are considered as disadvantageous, see page 6, lines 5 to 9. Starting from one of these known processes, the skilled person confronted with the technical problem of providing an alternative process was not induced by any of the documents cited in the search report to try a process comprising a precipitation step involving co-atomisation of two reactant solutions, a heat treatment, and an ultrasonication step. Neither is the board aware of some general knowledge that could induce the skilled person to try such a process when aiming at obtaining nanostructured metal oxides or hydroxides. The board concludes that the subject-matter of all claims is also based on an inventive step.

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 with the order to grant a patent with claims 1 to 12 according to the main request filed during the oral proceedings and a description to be adapted.

The Registrar | The Chairman

C. Vodz | M. Eberhard