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Datasheet for the decision of 19 June 2013

Case Number: T 1041/11 - 3.2.08

Application Number: 99973803.2

Publication Number: 1176219

IPC: C22C 27/02, H01M 8/04, C01B 3/00

Language of the proceedings: EN

Title of invention:
Alloy for hydrogen storage, method for absorption and release of hydrogen using the alloy, and hydrogen fuel cell using the method

Applicant:
Tohoku Techno Arch Co., Ltd.
Okada, Masuo
Dowa Holdings Co., Ltd.

Headword:
-

Relevant legal provisions:
EPC Art. 83, 84, 54

Keyword:
"Lack of disclosure (yes)"
"Lack of clarity of the claims (yes)"
"Novelty of the subject-matter of claim 1 (no)"

Decisions cited:
-

Catchword:
-

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Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number: T 1041/11 - 3.2.08

D E C I S I O N
of the Technical Board of Appeal 3.2.08
of 19 June 2013

Appellant: (Applicant 1)
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Decision under appeal: **Decision of the Examining Division of the European Patent Office posted on 22 October 2010 refusing European patent application No. 99973803.2 pursuant to Article 97(2) EPC.**

Composition of the Board:

Chairman: T. Kriner
Members: R. Ries
D. T. Keeling

Summary of Facts and Submissions

I. The appellants (applicants 1 to 3) lodged an appeal against the decision of the examining division dated 22 October 2010 to refuse European patent application No. 99973803.2. The examining division held amongst others that the subject-matter of claim 1 then on file lacked novelty over the disclosure of document

D1: JP-A-7 252 560

and therefore contravened the requirements of Articles 54 EPC.

The appeal was received at the European Patent Office on 21 December 2010, and the appeal fee was paid on the same date. The statement setting out the grounds of appeal was received on 1 March 2011.

II. The appellants requested that the decision under appeal be set aside and that a patent be granted on the basis of the set of claims filed on 23 January 2010.

Oral proceedings were requested in the event that the Board was likely to decide differently.

III. With a communication accompanying the summons to oral proceedings, the Board gave its provisional opinion on the appeal. The appellants were informed that the application did not appear to disclose the invention in a manner sufficiently clear and complete for it to be carried out by a person skilled in the art. Therefore, an objection arose under Article 83 EPC. Moreover, the claims were considered not to meet the requirement of

clarity and conciseness according to Article 84 EPC and the subject matter of claim 1 was found to lack novelty over the technical disclosure of document D1. A computer translation of document D1 was enclosed with the Board's communication.

IV. By its letter dated 12 June 2013, the appellants informed the Board that they would not attend the oral proceedings and did not intend to file any further facts and arguments in response to the Board's communication. The appellants asked the Board to decide on the basis of the documents currently on file.

V. Claims 1 to 6 of the set of claims 1 to 8 filed on 23 January 2010 read as follows:

"A method for absorbing and releasing hydrogen using a hydrogen storage metal alloy which comprises: applying repeatedly hydrogen pressurization and depressurization to the hydrogen storage metal alloy of a body-centered cubic structure-type phase exerting a two-stage or inclined plateau characteristic in a hydrogen storage amount vs hydrogen pressure relation in an appropriate fashion to absorb and release hydrogen, and at least at one stage during the release of hydrogen, making the temperature (T2) of the above-mentioned hydrogen storage metal alloy higher than the temperature (T1) of the hydrogen storage metal alloy during the hydrogen absorption process (T2 > T1), wherein the hydrogen storage metal alloy is an alloy having a suitably adjusted composition to reduce the stability of the occluded hydrogen and having a fundamental composition of the formula:

a) $V_aTi_{(41-0.4a+b)}Cr_{(59-0.6a-b)}$
wherein $0 \leq a \leq 70$ at% and $-10 \leq b \leq 10$ at%

or

b) $V_{(a-d)}M2_dTi_{(41-0.4a+b)}Cr_{(59-0.6a-b-c)}M_c$
wherein $0 \leq a \leq 70$ at%, $-10 \leq b \leq 10 + c$, $0 \leq c$, $0 \leq d \leq a$, M is at least one or more members selected from the group consisting of Nb, Mo, Ta, W, Mn, Fe, Al, B, C, Co, Cu, Ge, Ln (various lanthanoid metals), N, Ni, P and Si, and M2 is at least one or more members selected from the group consisting of Mo, Nb, Ta, W, Mn, Fe and Al."

"2. The method for absorbing and releasing hydrogen according to claim 1 wherein the alloy temperature (T1) during the hydrogen-absorbing process is within a range of from the extremely low temperature in the living areas on the earth to 373K."

"3. The method for absorbing and releasing hydrogen according to claim 1 or 2, wherein the composition ratio of the constituent metals for the alloy is adjusted to an appropriate range in order to reduce the stability of the hydrogen occluded in the alloy during the low-pressure plateau region or the lower plateau region of the inclined plateau such that the temperature of the said alloy can be brought to the above high temperature (T2) whereby at least part of the occluded hydrogen will be made desorbable during the low-pressure plateau region in the above mentioned two-stage plateau or the lower plateau region of the inclined plateau."

"4. The method for absorbing and releasing hydrogen according to any of claims 1 to 3, wherein the tissue

structure of the above-mentioned suitably adjusted hydrogen storage metal alloy is of a body-centered cubic structure mono phase without any spinodal decomposition phase or has a body-centered cubic structure together with only a minimum spinodal decomposition phase which is unavoidably produced."

"5. A hydrogen fuel battery equipped with: a hydrogen storage tank including a hydrogen storage metal alloy, a temperature controlling means whereby the above hydrogen storage metal alloy is directly heated or cooled or the atmospheric temperature of the said hydrogen storage metal alloy is raised or cooled, a fuel battery cell in which hydrogen supplied from said hydrogen storage tank can be subjected to a chemical change to output an electrical power, and a controller where a control is done in such a manner that, with regard to the temperature (T1) of the above hydrogen storage metal alloy during the stage of hydrogen absorption, the temperature of the said alloy during at least one period during the release of hydrogen is made higher (T2) than the temperature (T1) thereof during the above hydrogen-absorbing process, wherein the hydrogen storage metal alloy has as its main phase a body-centered cubic structure-type phase exerting a two-stage or inclined plateau characteristic in a hydrogen storage amount vs hydrogen pressure relation, and having a fundamental composition of the formula:

a) $V_aTi_{(41-0.4a+b)}Cr_{(59-0.6a-b)}$

wherein $0 \leq a \leq 70$ at% and $-10 \leq b \leq 10$ at%

or

b) $V_{(a-d)}M2_dTi_{(41-0.4a+b)}Cr_{(59-0.6a-b-c)}M_c$

wherein $0 \leq a \leq 70$ at%, $-10 \leq b \leq 10 + c$, $0 \leq c$, $0 \leq d \leq a$, M is at least one or more members selected from the group consisting of Nb, Mo, Ta, W, Mn, Fe, Al, B, C, Co, Cu, Ge, Ln (various lanthanoid metals), N, Ni, P and Si, and M2 is at least one or more members selected from the group consisting of Mo, Nb, Ta, W, Mn, Fe and Al

wherein the hydrogen fuel battery applies the method of any of claims 1 to 5."

"6. The hydrogen fuel battery according to claim 5, wherein the aforementioned controller is capable of appropriately controlling a pressure, temperature and flow rate of the hydrogen gas supplied from the above-mentioned hydrogen storage tank to the above-mentioned fuel battery cell."

Reasons for the Decision

1. The appeal is admissible.

2. Article 83 EPC

As regards sufficiency of disclosure, it is firstly necessary that the patent application describes at least one way of carrying out the claimed invention and secondly that the skilled person can put the invention into practice over the whole scope of the claim. In particular with respect to claims 1 and 4, much experimental work would be necessary to determine which alloy composition among those encompassed by formulae a) or b) actually satisfies the criterion of having a bcc structure with a two-stage plateau characteristic in a

hydrogen storage amount versus hydrogen pressure relation with no or a minimum spinodal decomposition.

Therefore the application does not meet the requirements of Article 83 EPC.

3. Clarity; Article 84 EPC:

For the following reasons, the present claims are not considered to meet the requirements of clarity and conciseness according to Article 84 EPC.

3.1 Claim 1 is concerned with a hydrogen storage metal alloy having a "*suitably adjusted* composition" to reduce the stability of occluded hydrogen and having a "*fundamental*" composition according to formula a) or b). It remains unclear which meaning the term "*suitably adapted*" is supposed to have and whether all the "*fundamental*" alloy compositions encompassed by formulae a) and b) represent a "*suitably adjusted composition*". Put the other way, it is unclear whether the skilled person has to select a "suitably adapted composition" within the "fundamental" alloy composition.

The method of claim 1 further requires that the temperature T_2 should be greater than T_1 without giving a specific temperature difference. Claim 1 thus includes the possibility that the difference between T_2 and T_1 is very small so that the claimed method cannot be unambiguously distinguished from the prior art which uses approximately the same temperature for the absorption-desorption cycles. Moreover, it remains doubtful whether a technical effect is obtained by the

claimed method for any temperature difference, in particular if the difference becomes small.

3.2 The term *"extremely low temperature in the living areas on the earth"* featuring in claim 2 is open to interpretation and therefore unclear in its meaning.

3.3 Claim 3 comprises relative expressions such as "for the alloy is adjusted to an "*appropriate*" range in order to reduce the stability of the hydrogen occluded during the "*low*" temperature region" and the *"high*" temperature (T_2).

3.4 As set out in claim 4, the suitably adjusted hydrogen storage alloy has a bcc structure (a) without or (b) with a "*minimum*" spinodal decomposition without giving an explanation which minimum is tolerable.

3.5 Independent claim 5 is concerned with a hydrogen fuel battery which is to be run by the method of claims 1 to 4 (not 5). Apart from the objections raised in connection with method claims 1 to 4, it is remains unclear which claim category claim 5 should belong to.

3.6 Moreover, it is unclear how the pressure, temperature and flow rate of hydrogen should be "*appropriately*" controlled by the controller, as set out in claim 6.

4. Novelty, Article 54 EPC

As far as claim 1 is understandable, its subject matter is not novel over the technical disclosure of document D1 (translation into English language). This document discloses in Table 1, No. 1 a hydrogen storage alloy

consisting of $Ti_{33}Cr_{13}V_{40}Fe_{12}Mn_2$ which meets formula b) featuring in claim 1. The alloy exhibits a bcc single phase structure (D1, paragraphs [0005], [0007]; [0011]). After the initial activation process, i.e. the absorption - desorption of hydrogen at about 80°C, the hydrogen storage alloy material is used (in the form of a hydrogen fuel battery) repeatedly in absorption - desorption cycles at about 20°C (D1, paragraphs [0001]; [0012]). Given that the difference between T_2 and T_1 is undetermined and could be very small and having regard to the fact that the temperature of the hydrogen storage material generally rises during the dehydriding step due to the exothermic desorption reaction (see the A1 publication of the application, paragraphs [0047], [0048]), the claimed process cannot be clearly distinguished from the method disclosed in D1.

Hence, the technical disclosure of document D1 anticipates the process set out in present claim 1.

5. The appellants dispensed with presenting any counter-arguments or statements in response to the Board's provisional opinion and withdrew their request for oral proceedings.

Given this situation, the request to grant a patent on the basis of the set of claims filed on 23 January 2010 cannot be allowed.

Order

For these reasons it is decided that:

The appeal is dismissed.

The Registrar: The Chairman:

V. Commare T. Kriner