PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference B30/0261	**FOR FURTHER ACTION**	See Form PCT/IPEA/416
International application No. PCT/IB2009/007549	International filing date *(day/month/year)* 24.11.2009	Priority date *(day/month/year)* 24.11.2008
International Patent Classification (IPC) or national classification and IPC INV. G21B3/00		
Applicant Piantelli, Silvia		

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 7 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
   a. ☒ *sent to the applicant and to the International Bureau)* a total of 4 sheets, as follows:
      ☒ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
      ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
   b. ☐ *(sent to the International Bureau only)* a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing, in electronic form only, as indicated in the Supplemental Box Relating to Sequence Listing (see paragraph 3*bis* of Annex C of the Administrative Instructions).

4. This report contains indications relating to the following items:

☒	Box No. I	Basis of the report
☐	Box No. II	Priority
☐	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
☐	Box No. IV	Lack of unity of invention
☒	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
☐	Box No. VI	Certain documents cited
☐	Box No. VII	Certain defects in the international application
☒	Box No. VIII	Certain observations on the international application

Date of submission of the demand	Date of completion of this report
2010-09-24	14.12.2010
Name and mailing address of the international preliminary examining authority: European Patent Office P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Fax: +31 70 340 - 3016	Authorized officer Capostagno, Eros Telephone No. +31 70 340-3221

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/IB2009/007549

Box No. I Basis of the report

1. With regard to the **language**, this report is based on

   ☒ the international application in the language in which it was filed

   ☐ a translation of the international application into , which is the language of a translation furnished for the purposes of:
   - ☐ international search (under Rules 12.3(a) and 23.1(b))
   - ☐ publication of the international application (under Rule 12.4(a))
   - ☐ international preliminary examination (under Rules 55.2(a) and/or 55.3(a))

2. With regard to the **elements*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

Description, Pages

1-26 as originally filed

Claims, Numbers

1-15 filed with telefax on 24-09-2010

Drawings, Sheets

1/8-8/8 as originally filed

☐ a sequence listing - see Supplemental Box Relating to Sequence Listing.

3. ☐ The amendments have resulted in the cancellation of:
   - ☐ the description, pages
   - ☐ the claims, Nos.
   - ☐ the drawings, sheets/figs
   - ☐ the sequence listing *(specify)*:
   - ☐ any table(s) related to sequence listing *(specify)*:

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since either they are considered to go beyond the disclosure as filed, or they were not accompanied by a letter indicating the basis for the amendments in the application as filed, as indicated in the Supplemental Box (Rules 70.2(c) and (c-bis)):
   - ☐ the description, pages
   - ☐ the claims, Nos.
   - ☐ the drawings, sheets/figs
   - ☐ the sequence listing *(specify)*:

5. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 70.2 (e)).

6. ☐ Supplementary international search report(s) from Authority(ies) have been received and taken into account in drawing up this report (Rule 45bis.8(b) and (c)).

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-15
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-15
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-15
	No:	Claims	

2. Citations and explanations (Rule 70.7):

see separate sheet

Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

Reference is made to the following documents:

D1: WO 95/20816 A1 cited in the application

D2: DE 40 24 515 A1 cited in the application

D4: DATABASE NANOWORD.NET retrieved on 20.10.2009 "CLUSTER" XP002551719 retrieved from HTTP://WWW.NANOWORD.NET/LIBRARY/DEFGEN/GEN ERATE.PHP?TERMID=146

and to the telefax of the Applicant of 24 September 2010.

1 Document D1 is regarded as being the closest prior art to the subject - matter of claim 14, and it discloses (see fig. 2; the references in parentheses applying to this document):

An energy generator, suitable for obtaining energy from nuclear fusion of hydrogen isotopes, said generator comprising

- an active core (1) comprising a predetermined amount of crystals of a transition metal;

- a generation chamber (2) containing in use the active core (1);

- a means (9) for heating the active core (1) in the chamber (1) up to a temperature higher than a predetermined critical temperature (page 8, par. 2);

- a means (page 13, par. 2) for removing from the chamber (1) the heat developed during the reactions in the active core (1).

2 The subject - matter of claim 14 therefore differs from this known energy generator in that:

- the energy is obtained from a succession of nuclear reactions between the hydrogen and the transition metal;

- it further comprises a means for triggering said nuclear reactions between the transition metal and the hydrogen by an impulsive action on the active core;

- the active core comprises a predetermined quantity of crystals of the transition metal, wherein such crystals are micro/nanometric clusters having a predetermined structure and comprise an average number of atoms of the transition metal less than a predetermined number of atoms; wherein

- when said means for heating the active core heats the cluster up to an adsorption temperature above the critical temperature, it causes an adsorption of hydrogen as H- ions into said cluster; and

- said means for triggering the nuclear reactions by an impulsive action on the active core, triggers nuclear reactions between said hydrogen as H- ions and said transition metal within the clusters, so as to cause said H- ions to be captured into respective atoms of said clusters with consequent production of heat.

The subject-matter of claim 14 is therefore new (Article 33(2) PCT).

3 The problem to be solved by the present invention may therefore be regarded as to enhance nuclear interactions between H- ions and atoms of a transition metal, with production of energy.

4 The solution proposed in claim 14 of the present application can be considered as involving an inventive step (Article 33(3) PCT) for the following reasons.

Known devices and methods proposed for the production of excess heat from nuclear fusion at low temperatures are **based on the mutual fusion of hydrogen (isotope) atoms** . The probability of fusion is enhanced by compressing the hydrogen atoms within a host metal lattice and by triggering the hydrogen fusion reactions with different (acoustical, mechanical, electrical, magnetic) means. The heat is generated as a direct consequence of such hydrogen atom fusion reactions. Examples of such devices are disclosed in D1 and D2.

The present invention is based on a different sequence of nuclear interactions **between hydrogen** (in its particular form of H- ions) **and nanosized clusters of the metal atoms**, i.e.:

- absorption of H- ions into the cluster (under specific conditions);

- formation of metal- hydrogen complex atoms (under specific triggering conditions);

- radiative capture of the H- ions by the core of the metal atoms, with consequent emission of a proton;

- exothermic reaction of the emitted proton with neighbouring cores.

The fact that a nanocluster exhibits different properties as a function of its number of atoms is known "per se" (see for example D4). Nevertheless, an energy generator based on the above sequence of nuclear reactions and comprising all the features of claim 14 is not known from, nor rendered obvious by, the available documents of the prior art.

The subject- matter of claim 14 can therefore be considered as involving an inventive step.

5 Independent claim 1 defines a method for producing energy by nuclear reactions between hydrogen and a metal, suitable for application to an energy generator such as defined in claim 14.

Mutatis mutandis, the subject- matter of claim 1 can therefore be considered as new and inventive.

Re Item VIII

6 Dependent claim 15 appears as redundant with respect to dependent claim 2.

7 The features of the claims are not provided with reference signs placed in parentheses (Rule 6.2 PCT).

8 In claim 14 (lines 22-23) the expression "which remains available for said nuclear reactions within said active core" is vague and leaves the reader in doubt as to the meaning of the technical features to which it refers. The same applies to claim 1 (lines 12-14).

9 In the description (page 3, lines 9-14), it is said that "the number of atoms that form each cluster is the variable through which the predetermined power can be obtained" and that "the power that can be obtained is substantially independent from the cluster size, i.e. the number of atoms that form the cluster".

This apparent contradiction should be clarified.

CLAIMS

1. A method for producing energy by nuclear reactions between hydrogen and a metal, said method providing the steps of:

– prearranging a predetermined quantity of crystals of a transition metal, said crystals arranged as micro/nanometric clusters having a predetermined crystalline structure, each of said clusters having a number of atoms of said transition metal less than a predetermined number of atoms;

– bringing hydrogen into contact with said clusters;

– heating said ~~determined quantity of~~ clusters up to an adsorption temperature larger than a predetermined critical temperature, and causing an adsorption into said clusters of hydrogen as H- ions, after said heating step said hydrogen as H- ions remaining available for said nuclear reactions within said active core;

– triggering said nuclear reactions between said hydrogen as H- ions and said metal within said clusters by an impulsive action on said active core that causes said H- ions to be captured into respective atoms of said clusters, said succession of reactions causing a production of heat;

– removing heat ~~according to a determined power~~ from said active core in order to obtain a determined power and to maintain~~ing~~ the temperature of said active core above said critical temperature.

2. A method according to claim 1, wherein said step of prearranging is carried out in such a way that said determined quantity of crystals of said transition metal in the form of micro/nanometric clusters is proportional to said power.

3. A method according to claim 1, wherein said step of prearranging a determined quantity of micro/nanometric clusters comprises a step selected from the group comprised of:

– depositing a predetermined amount of said transition metal in the form of micro/nanometric clusters on a surface of a substrate, i.e. a solid body that has an a predetermined volume and shape, wherein said substrate contains on its surface a number of clusters that is larger than a minimum number, in particular said minimum number at least 10^9 clusters per square centimetre, preferably at least 10^{10} clusters per square

centimetre, more in particular at least 10^{11} clusters per square centimetre, much more in particular at least 10^{12} clusters per square centimetre;

– aggregating said determined quantity of micro/nanometric clusters by sintering, said sintering preserving the crystalline structure of said clusters, said sintering preserving substantially the size of said clusters;

– collecting into a container a powder that is made of said clusters, i.e. a determined quantity of clusters or aggregation of loose clusters.

4. A method according to claim 3, wherein said step of depositing said transition metal is effected by a process of physical deposition on said substrate of a metal vapour that is made of said metal.

5. A method according to claim 3, wherein said step of depositing said transition metal is effected by a process selected from the group comprised of:

– sputtering;

– a process comprising evaporation or sublimation and then condensation on said substrate of said predetermined amount of said metal;

– epitaxial deposition;

– spraying;

– heating up to approaching the melting point followed by slow cooling, in particular up to an average core temperature of about 600°C,

6. A method according to claim 3, wherein after said step of depositing a predetermined amount of said transition metal a step is provided of quickly cooling said substrate and said deposited metal, in order to cause a "freezing" of said transition metal according to clusters having said crystalline structure, said step of quickly cooling selected from the group comprised of: tempering; causing a current of hydrogen to flow near said transition metal as deposited on said substrate, said hydrogen having a predetermined temperature that is lower than the temperature of said substrate.

7. A method according to claim 1, wherein said step of bringing hydrogen into contact with said clusters is preceded by a step of cleaning said substrate, in particular by applying a vacuum of at least 10^{-9} bar at a temperature set between 350°C and 500°C for a predetermined time, in particular said

vacuum applied according to at least 10 vacuum application cycles and following reinstatement of substantially atmospheric pressure of hydrogen.

8. A method according to claim 1, wherein during said step of bringing hydrogen into contact with said clusters said hydrogen satisfies at least one of the following conditions:

– it has a partial pressure set between 0,001 millibar and 10 bar, in particular between 1 millibar and 2 bar;

– it flows with a speed less than 3 m/s, in particular according to a direction substantially parallel to said surface of said clusters.

9. A method according to claim 1, wherein said adsorption temperature is close to a temperature of sliding the reticular planes of the transition metal, in particular a temperature set between the temperature corresponding to absorption peaks α and β.

10. A method according to claim 1, wherein after said heating step of said determined quantity of clusters a step is provided of cooling said active core up to room temperature, and said step of triggering said nuclear reactions provides a quick rise of said temperature of said active core from said room temperature to said adsorption temperature, in particular said quick rise is carried out in a time that is shorter than five minutes.

11. A method according to claim 1, wherein said step of triggering said nuclear reactions is associated with a step of creating a gradient, i.e. a temperature difference, between two points of said active core, said gradient in particular set between 100°C and 300°C, in order to enhance the anharmonicity of the reticular oscillations and to assist the production of the H- ions

12. A method according to claim 1, wherein said clusters have a face-centred cubic crystalline structure, fcc (110).

13. A method according to claim 1, wherein said reactions with production of heat occur in the presence of a magnetic and/or electric field selected from the group comprised of:

– a magnetic induction field of intensity set between 1 Gauss and 70000 Gauss;

– an electric field of intensity set between 1 V/m and 300000 V/m.

14. A energy generator that is obtained from a succession of nuclear reactions between hydrogen and a metal, wherein said metal is a transition metal, said generator comprising:

– an active core that comprises a predetermined amount of said transition metal;

– a generation chamber that in use contains said active core;

– a means for heating said active core within said generation chamber up to a temperature that is higher than a predetermined critical temperature;

– a means for triggering said nuclear reactions between said transition metal and said hydrogen by an impulsive action on said active core;

– a means for removing from said generation chamber the heat that is developed during said reactions within said active core according to a determined power,

——**characterised in that** said active core comprises a determined quantity of crystals of said transition metal, said crystals being micro/nanometric clusters that have a determined structure, said clusters comprising aon average a number of atoms of said transition metal that is less than a predetermined number of atoms, such that said when said means for heating heat said clusters up to an adsorption temperature larger than said critical temperature, an adsorption is caused into said clusters of hydrogen as H- ions which remains available for said nuclear reactions within said active core, and such that said means for triggering can trigger said nuclear reactions between said hydrogen as H- ions and said metal within said clusters by said impulsive action on said active core that causes said H- ions to be captured into respective atoms of said clusters with production of heat.

15. A method according to claim 1, wherein said determined quantity of crystals of said transition metal in the form of micro/nanometric clusters is proportional to said power.