

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter I of the Patent Cooperation Treaty)

(PCT Rule 44bis)

Applicant's or agent's file reference 18XS001P	FOR FURTHER ACTION		See item 4 below
International application No. PCT/JP2018/007286	International filing date (<i>day/month/year</i>) 27 February 2018 (27.02.2018)	Priority date (<i>day/month/year</i>) 28 March 2017 (28.03.2017)	
International Patent Classification (8th edition unless older edition indicated) See relevant information in Form PCT/ISA/237			
Applicant NATIONAL INSTITUTE FOR MATERIALS SCIENCE			

<p>1. This international preliminary report on patentability (Chapter I) is issued by the International Bureau on behalf of the International Searching Authority under Rule 44 bis.1(a).</p> <p>2. This REPORT consists of a total of 9 sheets, including this cover sheet.</p> <p>In the attached sheets, any reference to the written opinion of the International Searching Authority should be read as a reference to the international preliminary report on patentability (Chapter I) instead.</p>																								
<p>3. This report contains indications relating to the following items:</p> <table> <tr> <td><input checked="" type="checkbox"/></td> <td>Box No. I</td> <td>Basis of the report</td> </tr> <tr> <td><input type="checkbox"/></td> <td>Box No. II</td> <td>Priority</td> </tr> <tr> <td><input type="checkbox"/></td> <td>Box No. III</td> <td>Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</td> </tr> <tr> <td><input type="checkbox"/></td> <td>Box No. IV</td> <td>Lack of unity of invention</td> </tr> <tr> <td><input checked="" type="checkbox"/></td> <td>Box No. V</td> <td>Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</td> </tr> <tr> <td><input type="checkbox"/></td> <td>Box No. VI</td> <td>Certain documents cited</td> </tr> <tr> <td><input type="checkbox"/></td> <td>Box No. VII</td> <td>Certain defects in the international application</td> </tr> <tr> <td><input type="checkbox"/></td> <td>Box No. VIII</td> <td>Certain observations on the international application</td> </tr> </table> <p>4. The International Bureau will communicate this report to designated Offices in accordance with Rules 44bis.3(c) and 93bis.1 but not, except where the applicant makes an express request under Article 23(2), before the expiration of 30 months from the priority date (Rule 44bis .2).</p>	<input checked="" type="checkbox"/>	Box No. I	Basis of the report	<input type="checkbox"/>	Box No. II	Priority	<input type="checkbox"/>	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability	<input type="checkbox"/>	Box No. IV	Lack of unity of invention	<input checked="" type="checkbox"/>	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement	<input type="checkbox"/>	Box No. VI	Certain documents cited	<input type="checkbox"/>	Box No. VII	Certain defects in the international application	<input type="checkbox"/>	Box No. VIII	Certain observations on the international application
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	Date of issuance of this report 01 October 2019 (01.10.2019)
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TRANSLATION

From the
INTERNATIONAL SEARCHING AUTHORITY

PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43bis.1)

To:

Date of mailing (day/month/year)	10.04.2018
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Applicant's or agent's file reference 18XS001P	FOR FURTHER ACTION See paragraph 2 below
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International application No. PCT/JP2018/007286	International filing date (day/month/year) 27.02.2018	Priority date (day/month/year) 28.03.2017
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International Patent Classification (IPC) or both national classification and IPC
H01L35/32 (2006.01) i, H01L35/20 (2006.01) i, H02N11/00 (2006.01) i

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1. This opinion contains indications relating to the following items:

- Box No. I Basis of the opinion
- 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 Rule 43bis.1(a)(i) 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

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

Name and mailing address of the ISA/JP	Date of completion of this opinion	Authorized officer
Facsimile No.		Telephone No.

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Box No. I Basis of this opinion

1. With regard to the **language**, this opinion has been established on the basis of:
 - 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 (Rules 12.3(a) and 23.1(b)).
2. 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 43bis.1(a))
3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of a sequence listing:
 - a. forming part of the international application as filed:
 - in the form of an Annex C/ST.25 text file.
 - on paper or in the form of an image file.
 - b. furnished together with the international application under PCT Rule 13ter.1(a) for the purposes of international search only in the form of an Annex C/ST.25 text file.
 - c. furnished subsequent to the international filing date for the purposes of international search only:
 - in the form of an Annex C/ST.25 text file (Rule 13ter.1(a)).
 - on paper or in the form of an image file (Rule 13ter.1(b) and Administrative Instructions, Section 713).
4. In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that forming part of the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
5. Additional comments:

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Box No. V	Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement		
1. Statement			
Novelty (N)	Claims	2-17	YES
	Claims	1	NO
Inventive step (IS)	Claims	2-17	YES
	Claims	1	NO
Industrial applicability (IA)	Claims	1-17	YES
	Claims		NO
2. Citations and explanations:			
<p>Document 1: JP 11-177154 A (MURATA MANUFACTURING CO.) 02 July 1999, paragraphs [0017]-[0022], [0026]-[0028], fig. 1-2 (Family: none)</p> <p>Document 2: JP 2015-84364 A (DENSO CORP.) 30 April 2015, paragraphs [0039]-[0053], fig. 7A-9 & US 2016/0247995 A1, paragraphs [0058]- [0073], fig. 7A-9 & WO 2015/060301 A1 & EP 3062358 A1 & TW 201523938 A & KR 10-2016- 0060097 A & CN 105659399 A</p> <p>Document 3: JP 6-260686 A (JAPAN ENERGY CORP.) 16 September 1994, paragraph [0010], fig. 1-5 (Family: none)</p> <p>Document 4: JP 2015-233063 A (TOYOTA MOTOR CORP.) 24 December 2015, paragraph [0021], fig. 1 (Family: none)</p> <p style="margin-top: 20px;">The invention as in claim 1 lacks novelty and does not involve an inventive step in light of document 1 cited in the ISR.</p> <p style="margin-top: 10px;">Document 1 (paragraphs [0017]-[0022], [0026]-[0028], fig. 1-</p>			

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2) discloses an electric circuit device 12 for obtaining an electromotive force by using conductive patterns 4a, 4b having a Seebeck coefficient α of $30 \mu\text{V}/^\circ\text{C}$ and composed of Cu and Ni, wherein:

a plurality of substrates 3a, 3b, ... in which a thermocouple 5 and a contact point 6 are formed by conductive patterns 4a, 4b composed of different metals, are laminated, and through-holes 7a, 8a, 7b, 8b, ... are formed at both ends of the conductive patterns 4a, 4b of ... each of the substrates 3a, 3b;

each of the substrates 3a, 3b, ... has the conductive patterns 4a, 4b, has the thermocouple 5 arranged at one end, and has the contact point 6 arranged at the other end;

in addition, the positions of the through-holes 7a, 8a, 7b, 8b, ... are different in each of the upper and lower substrates 3a, 3b, a high voltage side through-hole provided in the lower layer substrate and a low voltage side through-hole provided in the upper layer substrate are provided at the same position, and the conductive patterns 4a, 4b and thermocouple 5 provided on the upper and lower substrates 3a, 3b, ... are connected in series through the through-holes 7a, 8a, 7b, 8b;

regions of the vertically laminated substrates 3a, 3b, in which the thermocouples 5 are formed vertically overlap, and regions thereof in which the contact points 6 are clustered also vertically overlap; and

an electric circuit element 9A, such as a power transistor, that emits a large amount of heat is disposed above and overlaps the region in which the thermocouple 5 of the thermoelectric conversion substrate 1 is formed.

The "electric circuit device 12 for obtaining an

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electromotive force by using conductive patterns 4a, 4b having a Seebeck coefficient α of $30 \mu\text{V}/^\circ\text{C}$ and composed of Cu and Ni" disclosed in document 1 corresponds to the "thermoelectric generation cell using thermoelectric generation by means of the Seebeck effect of a metal material" of the invention as in claim 1.

In addition, the feature of the invention disclosed in document 1 in which "regions of the vertically laminated substrates 3a, 3b, in which the thermocouples 5 are formed vertically overlap, and regions thereof in which the contact points 6 are clustered also vertically overlap" corresponds to the "temperature difference maintaining part for maintaining the temperature difference between a high temperature part and a low temperature part of the metal material" of the invention as in claim 1.

Moreover, the "conductive patterns 4a, 4b composed of different metals" connecting the "vertically overlapping" "thermocouples 5" of the invention disclosed in document 1 "via through-holes 7a, 8a, 7b, 8b, ..." in the "regions in which the contact points 6 are clustered and which are" different from the "regions in which the thermocouple 5 are formed" correspond to the "member made of a metal material and having a structure that minimizes the internal resistance indicating the relationship between voltage and current in a thermoelectric generation cell" in the invention as in claim 1.

The invention as in claims 2-8 is novel and involves an inventive step in relation to the documents cited in the ISR.

The feature of the invention as in claim 2 which pertains to a "thermoelectric generation cell provided with: a plurality

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of laminates formed by laminating a plurality of thermoelectric generation units; a heat collection plate (8) provided on a heating part (11) side of the plurality of laminates; and a heat dissipation plate (9) provided on a heat dissipation part side of the plurality of laminates, wherein the thermoelectric generation units are each provided with a first metal thin plate (1), a second metal thin plate (2) bonded to the first metal thin plate, an insulation film (3) overlapping a facing surface, of the second metal thin plate, facing a bonding surface (6) between the first and second metal thin plates, a first wire (4) connected to the first metal thin plate and made of the same material as the first metal thin plate, a second wire (5) connected to the second metal thin plate and made of the same material as the second metal thin plate, and a cold contact point (7) contacting ends of the first and second wires at the opposite end of the ends connected to the first and second metal thin plates” and

the feature of the invention as in claim 3 which pertains to a “thermoelectric generation cell provided with: a plurality of laminates formed by laminating a plurality of thermoelectric generation units; a heat collection plate provided on a heating part (111) side of the plurality of laminates; and a heat dissipation plate (109) provided on a heat dissipation part side of the plurality of laminates, wherein the thermoelectric generation units are each provided with a first metal thin plate (101), a second metal thin plate (102) bonded to the first metal thin plate, an insulation film (103) overlapping a facing surface, of the second metal thin plate, facing a bonding surface (106) of the first and second metal thin plates, a first extended conductor part (104) connected to the first metal thin plate and made of the same material as the first metal thin plate, a second extended

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conductor part (105) connected to the second metal thin plate and made of the same material as the second metal thin plate, and a cold contact point (107) contacting ends of the first and second extended conductor parts at the opposite end of the ends connected to the first and second metal thin plates" are not disclosed or suggested in any of the documents cited in the ISR, and could not be easily conceived of even by a person skilled in the art, even when considering the common technical knowledge at the time of filing.

In addition, the same applies to the invention as in claims 4-8 which refer to claim 2 or 3.

The invention as in claims 9-17 is novel and involves an inventive step in relation to the documents cited in the ISR.

The feature of the invention as in claim 9 which pertains to a "thermoelectric generation cell provided with: a refractory material frame (210) for maintaining a plurality of thermoelectric generation units in a laminated state in which adjacent thermoelectric generation units are insulated from each other; a heating part (211) provided on the refractory material frame and heating the plurality of laminates of the thermoelectric generation units; and a cooling insulation oil part (212) provided on a cooling part side of the thermoelectric generation units, wherein the thermoelectric generation units have a structure that extends between the refractory material frame and the cooling insulation oil part, and comprise: a first band-shaped metal thin plate (201) having a structure that extends between the refractory material frame and the cooling insulation oil part; a second band-shaped metal thin plate (202) having a structure that extends between the refractory material frame and the cooling insulation oil part and bonded to the first band-shaped metal

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thin plate through the refractory material frame; an insulation layer (203) formed on the surface on the opposite side of the first and second band-shaped metal thin plates from the bonding surface (206) of the first and second band-shaped metal thin plates; and a cold contact point (207) positioned in a region on the opposite side of the first and second band-shaped metal thin plates from the bonding surface and having a structure that is cooled by the cooling insulation oil part" and

the feature of the invention as in claim 13 which pertains to a "structure provided with: a refractory material frame (310) for maintaining a plurality of thermoelectric generation units in a laminated state in which adjacent thermoelectric generation units are insulated from each other; a heating part (311) provided on the refractory material frame and heating the plurality of laminates of the thermoelectric generation units; and first and second cooling insulation oil parts (312a, 312b) provided on both sides of the refractory material frame, and provided on first and second cooling part sides of the thermoelectric generation units, wherein the thermoelectric generation units are elongated and extend between the first cooling insulation oil part, the refractory material frame, and the second cooling insulation oil part" are not disclosed or suggested in any of the documents cited in the ISR, and could not be easily conceived of even by a person skilled in the art, even when considering the common technical knowledge at the time of filing.

In addition, the same applies to the invention as in claims 10-12 which refer to claim 9 and the invention as in claims 14-17 which refer to claim 13.