

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 1754YUW	FOR FURTHER ACTION		See item 4 below
International application No. PCT/JP2017/026056	International filing date (<i>day/month/year</i>) 19 July 2017 (19.07.2017)	Priority date (<i>day/month/year</i>) 31 August 2016 (31.08.2016)	
International Patent Classification (8th edition unless older edition indicated) See relevant information in Form PCT/ISA/237			
Applicant NGK SPARK PLUG CO., LTD.			

<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 11 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 checked="" 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 checked="" type="checkbox"/>	Box No. VIII	Certain observations on the international application
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	Date of issuance of this report 05 March 2019 (05.03.2019)
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PATENT COOPERATION TREATY

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)	03.10.2017
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Applicant's or agent's file reference 1754YUW	FOR FURTHER ACTION See paragraph 2 below
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International application No. PCT/JP2017/026056	International filing date (day/month/year) 19.07.2017	Priority date (day/month/year) 31.08.2016
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International Patent Classification (IPC) or both national classification and IPC
H05K3/24 (2006.01) i, H01L23/12 (2006.01) i, H05K1/09 (2006.01) i

Applicant
NGK SPARK PLUG CO., LTD.

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
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1. Statement									
Novelty (N)		<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 10%; padding: 2px;">Claims</td> <td style="border-bottom: 1px solid black; padding: 2px;">2, 4-6, 11-13</td> <td style="width: 10%; padding: 2px;">YES</td> </tr> <tr> <td style="padding: 2px;">Claims</td> <td style="border-bottom: 1px solid black; padding: 2px;">1, 3, 7-10, 14</td> <td style="padding: 2px;">NO</td> </tr> </table>	Claims	2, 4-6, 11-13	YES	Claims	1, 3, 7-10, 14	NO	
Claims	2, 4-6, 11-13	YES							
Claims	1, 3, 7-10, 14	NO							
Inventive step (IS)		<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 10%; padding: 2px;">Claims</td> <td style="border-bottom: 1px solid black; padding: 2px;">2</td> <td style="width: 10%; padding: 2px;">YES</td> </tr> <tr> <td style="padding: 2px;">Claims</td> <td style="border-bottom: 1px solid black; padding: 2px;">1, 3-14</td> <td style="padding: 2px;">NO</td> </tr> </table>	Claims	2	YES	Claims	1, 3-14	NO	
Claims	2	YES							
Claims	1, 3-14	NO							
Industrial applicability (IA)		<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 10%; padding: 2px;">Claims</td> <td style="border-bottom: 1px solid black; padding: 2px;">1-14</td> <td style="width: 10%; padding: 2px;">YES</td> </tr> <tr> <td style="padding: 2px;">Claims</td> <td style="border-bottom: 1px solid black; padding: 2px;"></td> <td style="padding: 2px;">NO</td> </tr> </table>	Claims	1-14	YES	Claims		NO	
Claims	1-14	YES							
Claims		NO							

2. Citations and explanations:	
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Document 1: JP 2003-234552 A (KYOCERA CORP.) 22 August 2003, paragraphs [0017], [0037]-[0054], [0058], fig. 2 (Family: none)

Document 2: JP 2003-100952 A (KYOCERA CORP.) 04 April 2003, paragraphs [0014]-[0019], [0031]-[0034], fig. 2 (Family: none)

Document 3: JP 2006-41225 A (DENSO CORP.) 09 February 2006, paragraphs [0008], [0010], [0043]-[0048], [0055], [0056], [0078], fig. 6 (Family: none)

Document 4: WO 2008/081758 A1 (TOKUYAMA CORP.) 10 July 2008, paragraphs [0026]-[0040], [0051], table 1, fig. 1 & US 2010/0015468 A1, paragraphs [0036]-[0054], [0065], table 1, fig. 1 & EP 2099068 A1

Document 5: JP 2000-323618 A (SUMITOMO ELECTRIC INDUSTRIES, LTD.) 24 November 2000, paragraphs [0030]-[0033], [0042], fig. 1 (Family: none)

The invention as in claims 1, 3, 7, 8, 10, and 14

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lacks novelty and does not involve an inventive step in the light of document 1 cited in the ISR.

Document 1 discloses a wiring substrate 4, in which a palladium plating layer 7 (corresponding to the "electrically conductive layer") is deposited onto an exposed surface of a wiring layer 2 (corresponding to the "conductive base layer") formed by applying, by printing, a conductive paste that comprises tungsten and/or molybdenum to a sheet-shaped molded body that includes an aluminum oxide raw material powder as a primary constituent of a ceramic sintered body and sintering the conductive paste (corresponding to "forming by metallization"), then, by heat-treatment (corresponding to "softening by heating") at a temperature of approximately 800-900°C, the palladium plating layer 7 and the wiring layer 2 are diffusion-bonded, a copper plating layer 8 (corresponding to the "surface layer") is further formed by deposition on the palladium plating layer 7, and, by further depositing a covering metal plating layer (corresponding to the "surface plating layer") on the surface of the copper plating layer 8, strong bonds can be established between the wiring layer, the palladium plating layer, and the copper plating layer and peeling can be prevented. Moreover, on the basis of document 1 (fig. 2), it is clear that part of the palladium plating layer 7 forms a diffusion layer (corresponding to the "intermediate layer") with the wiring layer 2 and the remainder is present as a palladium layer. Moreover, it is common technical knowledge that the materials of the layers are non-magnetic.

This being the case, the invention disclosed in

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document 1 and the invention as in claims 1, 3, 7, 8, 10, and 14 of the present application are identical.

The invention as in claims 4 and 11 does not involve an inventive step in the light of documents 1 and 2 cited in the ISR.

The invention disclosed in document 1 differs from the invention as in claims 4 and 11 in that a feature in which a palladium plating layer is provided between the copper plating layer 8 (corresponding to the "surface layer") and the metal plating layer that covers the surface of the copper plating layer 8 is not disclosed.

This difference will be considered below.

Document 2 discloses a feature in which, by providing a palladium plating metal layer 8 (corresponding to the "palladium plating layer") between a copper plating layer 7 (corresponding to the "surface layer") on a wiring layer 2 formed by sintering a metal powder of tungsten or the like and a metal plating layer 9 (corresponding to the "surface plating layer") disposed on a surface of the copper plating layer, diffusion of the copper plating layer and the metal plating layer is prevented and adhesion between these layers can be strengthened.

The invention disclosed in document 1 and the invention disclosed in document 2 have similar structures, in that both comprise a copper plating layer and a metal plating layer on a metallized wiring layer of tungsten or the like, and both have the same purpose, that of strengthening adhesion between layers. Thus, a person skilled in the art could easily conceive of applying the feature disclosed in document 2 to the

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

invention of document 1, so that a palladium plating layer is provided between the copper plating layer and the metal plating layer, preventing diffusion of these layers and strengthening adhesion.

The invention as in claims 5, 6, 12, and 13 does not involve an inventive step in the light of documents 1 and 3 cited in the ISR.

The invention disclosed in document 1 differs from the invention as in claims 5, 6, 12, and 13 in that a feature in which a vent hole section that is a convex section is formed in a surface of the wiring layer 2 (corresponding to the "conductive base layer") and a feature in which a material of a specific type is removed from the wiring layer 2 are not disclosed.

These differences will be considered below.

Document 3 discloses a feature in which, following sintering of a conductive paste comprising a mixed material (corresponding to the "material including particles") in which a metal powder comprising tungsten and an inorganic material powder (corresponding to the "material of a specific type") are mixed, copper plating 150 (corresponding to the "surface layer") is applied onto wiring (corresponding to the "conductive base section") in which a concave section M1 (corresponding to the "vent hole section that is a concave section") is formed in surfaces of wiring 15, 16 by removal of the inorganic material powder in the mixed material through etching, whereby the anchor effect is improved and adherence can be improved.

The invention disclosed in document 1 and the invention disclosed in document 3 have similar

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configurations, in that a copper plating layer is provided on a metallized wiring layer of tungsten or the like, and both have the same purpose, that of strengthening adhesion by improving adherence between layers. Thus, a person skilled in the art could easily conceive of employing the feature disclosed in document 3 in the wiring layer 2 of the invention of document 1, that adhesion between the wiring layer 2 and the palladium plating layer is improved.

The invention as in claims 8, 9, 10, and 14 lacks novelty and does not involve an inventive step in the light of document 4 cited in the ISR.

Document 4 (see embodiment 21 in table 1) discloses features in which a high-melting-point metal layer 20 (corresponding to the "conductive paste section") is formed by applying and sintering (corresponding to "metallizing") a high-melting-point metal paste, copper is formed on the high-melting-point metal layer 20 by plating as an intermediate metal layer 30 (corresponding to the "electrically conductive layer"), after heat treatment in a non-oxidizing atmosphere at 850°C, a silver paste is applied, and a surface metal layer 40 (corresponding to the "surface layer") is formed by sintering in a non-oxidizing atmosphere at 910°C so that the high-melting-point metal layer 20, the intermediate metal layer 30, and the surface metal layer 40 bond strongly, and bonding strength between the layers is increased, and, in addition, metal plating (corresponding to the "surface layer") can be performed on top of the surface metal layer 40. Moreover, it is common technical knowledge that the materials of these layers are non-

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magnetic. After formation of the intermediate metal layer 30, heat treatment is performed at 850°C, which is at least 80% of the melting point of copper (melting point of copper 1358 K \times 80% = 1086 K = 813°C), and it is therefore highly probable that a diffusion layer (corresponding to the "intermediate layer") of the material that forms these layers is formed between the high-melting-point metal layer 20 and the intermediate metal layer 30 (see the description (paragraph [0015]) of the present application).

This being the case, the invention disclosed in document 4 and the invention as in claims 8, 9, 10, and 14 of the present application are identical.

The invention as in claim 2 is not disclosed in any of the documents cited in the ISR, is novel, and involves an inventive step.

Documents 1-4 disclose the content described above.

Document 5 discloses a feature in which a high-melting-point metal layer of tungsten or the like, an interposed metal layer such as a Cu-P layer, and a conductive layer of oxygen-free copper or the like are layered, in that order, and heated to melt the interposed metal layer and bond the layers.

However, document 5 does not disclose features in which a first step in which an electrically conductive layer formed using copper or silver is formed on a surface of a conductive base section that is non-magnetic, a second step in which the electrically conductive layer is softened or melted by heating and then hardened by cooling, and a third step in which a surface layer in which copper or silver is used is formed

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by plating on a surface of the hardened electrically
conductive layer are included, and a person skilled in
the art could not easily conceive of these features, even
taking into consideration common technical knowledge at
the time the application was filed.

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:

In the invention as in claim 1, it is set forth that "the electrically conductive layer is softened by heating," but the degree of softening, i.e., to what degree the electrically conductive layer softens with respect to what kind of state, is not set forth, and the degree of this "softening" is unclear. Moreover, consequently, the range of heating conditions for "softening by heating" is also unclear.

Thus, the invention as in claim 1 is not clear.

In this written opinion, with reference to the description (paragraph [0011]) of the present application, the search was conducted with "softening by heating" limited to a case in which heating to a degree at which the constituents of the conductive base section and the constituents of the electrically conductive layer mutually heat-diffuse.