

From the INTERNATIONAL SEARCHING AUTHORITY

To:

PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43bis.1)

Date of mailing (day/month/year) 13 September 2017	
Applicant's or agent's file reference 2017003	FOR FURTHER ACTION See paragraph 2 below
International application No. PCT/CN2017/095365	International filing date (day/month/year) 01 August 2017
Priority date (day/month/year) 01 August 2016	
International Patent Classification (IPC) or both national classification and IPC H01G 11/30(2013.01)i	
Applicant XIFENG 2D (FUJIAN) MATERIAL TECHNOLOGY COMPANY 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 and 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/	Date of completion of this opinion	Authorized officer
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International application No.

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Box No. I Basis of the 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 43*bis*.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 filed or furnished:
 - a. (means)
 - on paper
 - in electronic form
 - b. (time)
 - in the international application as filed
 - together with the international application in electronic form
 - subsequently to this Authority for the purposes of search
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 in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
5. Additional comments:

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International application No.

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Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step and industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	<u>1-10</u>	YES
	Claims	<u>None</u>	NO
Inventive step (IS)	Claims	<u>None</u>	YES
	Claims	<u>1-10</u>	NO
Industrial applicability (IA)	Claims	<u>1-10</u>	YES
	Claims	<u>None</u>	NO

2. Citations and explanations :

[1] The following reference documents are cited:

[2] D1: CN 103682368 A, 26 March 2014 (26.03.2014)

[3] D2: CN 105591088 A, 18 May 2016 (18.05.2016)

[4] 1. Novelty

[5] Claim 1 sets forth a method for preparing a three-dimensional graphene / MoS₂ composite material. D1 discloses a method for preparing a battery electrode (see description, paragraphs [0006] - [0025], [0042] and [0043]). As to the electrode above, an ultra-light and flexible three-dimensional graphene foam is used as a current collector, and an active material is embedded into the surface or cavity of the three-dimensional graphene foam by means of a hydrothermal process, so as to form a lithium ion battery electrode. The active material may be MoS₂. The hydrothermal process comprises: placing a graphene foam in an aqueous solution containing cations and anions of the active material, transferring the solution added with the graphene foam into a reactor, performing a reaction at 30 to 300 °C for 0 to 48 hours, taking out the graphene foam, and calcining same at 0 to 800 °C for 0 to 24 hours in an inert atmosphere. The method for preparing the three-dimensional graphene foam comprises: placing a foamed nickel in a reaction furnace; heating same to 1000 °C in an atmosphere of hydrogen gas and argon (the flow rate of argon is 500 milliliters/minutes), introducing a mixed gas of methane, hydrogen gas and argon, starting to grow graphene, the growth time being 5 min, and rapidly cooling graphene once growth has come to an end. A solution of PMMA in ethyl lactate is added dropwise to the surface of the foamed nickel with the surface coated with graphene, and after drying, the foamed nickel template is placed in hydrochloric acid for dissolution. PMMA is dissolved and removed by means of acetone at a temperature of 55 °C to obtain a graphene foam having a three-dimensional connected network. The carbon source may be methane, ethane, toluene, ethanol, and methanol. The dissolving solution for removing the foamed metal may be hydrochloric acid or aqueous iron chloride solution.

[6] D2 discloses a method for preparing a negative electrode material of a battery (see description, paragraphs [0006] - [0011]), comprising: (1) dissolving a molybdenum salt and a sulfur source in deionized water, adding polyvinylpyrrolidone, adjusting pH to acidity, adding graphene oxide, and performing ultrasonication so as to obtain a homogeneous mixed solution, the concentration of the molybdenum salt being 6×10^{-3} to 3×10^{-1} mol/L; (2) adding the mixed solution to a hydrothermal kettle to be reacted for 6 to 24 hours; (3) washing the product by means of deionized water and ethanol, the product being vacuum dried to obtain a precursor powder; and (4) performing heat treatment on the precursor powder at a temperature for 1 to 3 hours under the protection of an inert gas, and cooling same to room temperature. The molybdenum salt may be ammonium molybdate, sodium molybdate, organic molybdenum salt, and the like. The sulfur source may be thioacetamide. The molar ratio of sulfur source to molybdenum source is (4-10): 1. The reaction temperature in step (2) is 160 to 220 °C. The temperature of step (4) is 400 to 800 °C.

[7] Therefore, the subject matter of claim 1 is not disclosed in D1 and D2, and claim 1 complies with PCT Article 33(2).

[8] Dependent claims 2-10 directly or indirectly refer to claim 1, and the subject matter thereof is not disclosed by D1 or D2. Therefore, claims 2-10 comply with PCT Article 33(2).

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Box No. V

Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step and industrial applicability;
citations and explanations supporting such statement

[9] 2. Inventive Step

[10] Claim 1 differs from D1 in that claim 1 specifically defines the hydrothermal method, and further comprises an annealing treatment. However, D2 discloses specific steps of the hydrothermal preparation method and a step of annealing the graphene / MoS₂ composite material, and provides the technical inspiration. Polyvinylpyrrolidone is a common dispersant, and a person skilled in the art would have been able to choose whether to use the dispersant above.

[11] The additional technical features of claims 2-10 are either disclosed in D1 or are conventional technical knowledge in the art.

[12] Therefore, claims 1-10 do not involve an inventive step and do not comply with PCT Article 33(3).

[13] 3. Industrial Applicability

[14] The subject matter of claims 1-10 can be used in the field of batteries, and therefore said claims are industrially applicable in the sense of PCT Article 33(4).