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Declarations under Rule 4.17:

— of inventorship (Rule 4.17(iv))

Published:

— with international search report (Art. 21(3))

— before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))

(88) Date of publication of the international search report:

28 November 2013

(54) Title: STRUCTURED SILICON PARTICLES

(57) Abstract: A composite particle is provided. The particle comprises a first particle component and a second particle component in which: (a) the first particle component comprises a body portion and a surface portion, the surface portion comprising one or more structural features and one or more voids, whereby the surface portion and body portion define together a structured particle; and (b) the second component comprises a removable filler; characterised in that (i) one or both of the body portion and the surface portion comprise an active material; and (ii) the filler is contained within one or more voids comprised within the surface portion of the first component. The use of the particle in applications such as electrochemical cells, metal-ion batteries such as secondary battery applications, lithium air batteries, flow cell batteries, fuel cells, solar cells, filters, sensors, electrical and thermal capacitors, micro-fluidic devices, gas or vapour sensors, thermal or dielectric insulating devices, devices for controlling or modifying the transmission, absorption or reflectance of light or other forms of electromagnetic radiation, chromatography or wound dressings is disclosed.



INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2013/050507

A. CLASSIFICATION OF SUBJECT MATTER
 INV. H01M4/36 A61K47/02 A61K9/14 C09C3/00 H01M4/38
 H01M4/04 H01M4/13 H01M10/0525
 ADD.
 According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED
 Minimum documentation searched (classification system followed by classification symbols)
 A61K C09C H01M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
 EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2009/137688 A1 (YANG HONGLI [GB]) 28 May 2009 (2009-05-28)	1-6, 8-27,41
Y	paragraphs [0002], [0008] - [0078] -----	7,37-40
Y	CN 101 591 478 A (XIAODONG LI [CN] LIANYUNGANG DONGHAI SILICON MICROPOWDER CO LTD) 2 December 2009 (2009-12-02) pages 3-5; claim 1 -----	7,37-40

Further documents are listed in the continuation of Box C.

See patent family annex.

* Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier application or patent but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
- "&" document member of the same patent family

Date of the actual completion of the international search
 24 July 2013

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/GB2013/050507

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.

3. As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-27(completely); 37-41(partially)

Remark on Protest

- The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-27(completely); 37-41(partially)

A composite particle comprising a first particle component and a second particle component in which:(a) the first particle component comprises a body portion and a surface portion, the surface portion comprising one or more structural features and one or more voids, whereby the surface portion and body portion define together a structured particle; and(b) the second component comprises a removable filler; characterised in that (i) one or both of the body portion and the surface portion comprise an active material; (ii) the filler is contained within one or more voids comprised within the surface portion of the first component; and (iii) the filler either has a sublimation or disintegration temperature of at least 50 °C and/or is soluble in an ionic liquid or an electrolyte solution.

2. claims: 28-36(completely); 37-41(partially)

A composite material comprising a composite particle and a binder.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/GB2013/050507

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2009137688	A1	28-05-2009	EP 1965767 A2 10-09-2008
			US 2009137688 A1 28-05-2009
			WO 2007071915 A2 28-06-2007

CN 101591478	A	02-12-2009	NONE
