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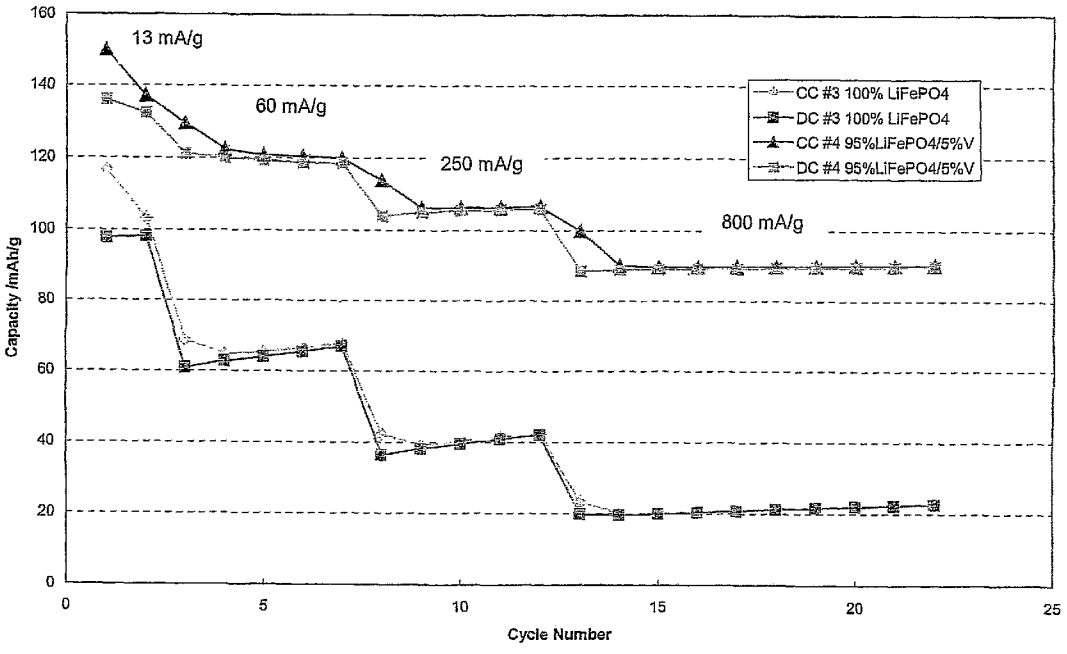
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Published:
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6 December 2007

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: ELECTRODE MATERIAL WITH ENHANCED IONIC TRANSPORT PROPERTIES



(57) Abstract: Materials useful as electrodes for lithium batteries have very good electronic and ionic conductivities. They are fabricated from a starting mixture which includes a metal, a phosphate ion, and an additive which enhances the transport of lithium ions in the resultant material. The mixture is heated in a reducing environment to produce the material. The additive may comprise a pentavalent metal or a carbon. In certain embodiments the material is a two-phase material. Also disclosed are electrodes which incorporate the materials and lithium batteries which incorporate those electrodes.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 06/04220

A. CLASSIFICATION OF SUBJECT MATTER
IPC (8): H01M 4/58 (2007.01)
USPC: 423/306
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)
USPC: 423/306

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)

Electronic Databases Searched: USPTO WEST (PGPUB, EPAB, JPAB, USPT), Google, Thomson dialog. Search Terms Used: phosphorus, lattice, carbon, ionic, vanadium or molybdenum or carbon, metal, additive?, phosphate, electr$ and conduct$, lithium adj batter$

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2004/0005265 A1 (Chiang et al.) 08 January 2004 (08.01.2004), entire document, especially para [0003], [0007], [0052], [0084], [0010]-[0013], [0022], [0063], [0066], [0090]-[0091], [0093], [0120], [0167], [0170], [0196] and [0209]	1-28

☐ Further documents are listed in the continuation of Box C. ☐

* 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	Date of mailing of the international search report
10 July 2007 (10.07.2007)	13 SEP 2007
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	Authorized officer: Lee W. Young PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 06/04220

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:
Group 1: Claims 1-28
Group 2: Claims 29-32

Claims 1-28, having independent claim 1 are directed a method of synthesizing a material including: providing a starting material which includes lithium, a metal, a phosphate ion, and an additive and heating the mixture to produce Li.sub.xMPO.sub.4.

Claims 29-32, having independent claim 29, are directed to a material that when incorporated into a lithium battery, the lithium ion conductivity to the material is in the range of 10.sup.-6 S/cm to 5 x 10.sup.-4 S/cm.

Groups 1 and 2 do not share a special technical feature that would otherwise provide a unifying contribution over the prior art. Therefore, unity is lacking.

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 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.:
1-28

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.