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61/033,719 4 March 2008 (04.03.2008) US(71) Applicant (for all designated States except US): **LOCKHEED MARTIN CORPORATION** [US/US]; 6801 Rockledge Drive, Bethesda, MD 20817 (US).

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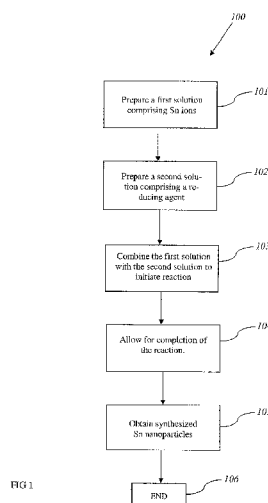
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(54) Title: TIN NANOPARTICLES AND METHODOLOGY FOR MAKING SAME



(57) Abstract: A method of preparing tin (Sn) nanoparticles based on a bottom-up approach is provided. The method includes combining a first solution comprising Sn ions with a second solution comprising a reducing agent. After the combination, the Sn ions and the reducing agent undergo a reaction in which at least some of the Sn ions are reduced to Sn nanoparticles. The first solution comprises a tin salt dissolved in a solvent; the second solution comprises an alkali metal and naphthalene dissolved in a solvent; and the combined solution further comprises a capping agent that moderates a growth of aggregates of the Sn nanoparticles.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 09/35904

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - B32B 15/02 (2009.01)

USPC - 428/646

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)

IPC(8) - B32B 15/02 (2009.01)

USPC - 428/646

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
USPC - 428/646, 546; 429/12

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

PubWEST(PGPB,USPT,USOC,EPAB,JPAB); WIPO; Web: Google, Google Scholar

Search Terms Used: tin, Sn, nanoparticle, solution, ions, reducing agent, reaction, alkali metal, sodium, lithium, potassium, naphthalene, capping agent, aggregate, chloride, solvent, glycol ether, glyme, triglyme, battery, lithium battery, anode

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2007/0298536 A1 (Ren et al.) 27 December 2007 (27.04.2007) Entire document, especially: Fig 5d, 11d; abstract; para [0010], [0014], [0018], [0033], [0034], [0036], [0037], [0040], [0041], [0050]	1-16
Y	US 2006/0046447 A1 (Yamamoto) 02 March 2006 (02.03.2006) Entire document, especially: Fig 3, 5; abstract; para [0023], [0041], [0063], [0065], [0067], [0075], [0084], [0087]	1-18
Y	Balan, L., Schneider, R., Billaud, D., Ghanbaja, J., "A new organometallic synthesis of size-controlled tin(0) nanoparticles," 2005, Nanotechnology Vol 16, p 1153-1158, 17 May 2005. (abstract) [online]. Retrieved from the Internet on [06 April 2009]. Retrieved from: <URL: http://www.iop.org/EJ/article/0957-4484/16/8/029/nano5_8_029.pdf?request-id=5d32d155-070f-4fa5-8afa-09f1f031b985 > Entire document, especially: Table 1, eq. 1, p 1153-1155	2, 4, 12
Y	Balan, L., Schneider, R., Billaud, D., Ghanbaja, J., "Novel low-temperature synthesis of tin(0) nanoparticles," 2005, Materials Letters Vol 59, p 1080-1084, 31 December 2004. (abstract) [online]. Retrieved from the Internet on [06 April 2009]. Retrieved from: <URL: http://www.sciencedirect.com/science?_ob=MIimg&_imagekey=B6TX9-4F4WXP7-7-1&_cdi=5585&_user=10&_orig=search&_coverDate=04%2F01%2F2005&_sk=999409991&vie w=c&wchp=dGLbVzz-zSkzV&md5=5df2a3915cc40c03117e855eb3205ab8&ie=/sdarticle.pdf > Entire document, especially: eq. 1, p 1081	3, 11

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"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

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"&" document member of the same patent family

Date of the actual completion of the international search

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International application No.

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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	✓ Zhao, Y., Zhang, Z., Dang, H., "Preparation of tin nanoparticles by solution dispersion," 2003, Materials Science and Engineering A Vol 359, p 405-407, May 2003. (abstract) [online]. Retrieved from the Internet on [06 April 2009]. Retrieved from: <URL: http://www.sciencedirect.com/science?_ob=Mimg&_imagekey=B6TXD-497YV5Y-F-9&_cdi=5588&_user=952835&_orig=search&_coverDate=10%2F25%2F2003&_sk=996409998&view=c&wchp=dGLzVzz-zSkzk&md5=285375ebac32a99de7822cb36ad442c6&ie=/sdarticle.pdf> Entire document, especially: abstract, p 406, 407	16
Y	✓ WO 2008/023944 A1 (Kim et al.) 28 February 2008 (28.02.2008) Entire document, especially: col 7, ln 10-30; col 17, ln 10-20	17, 18