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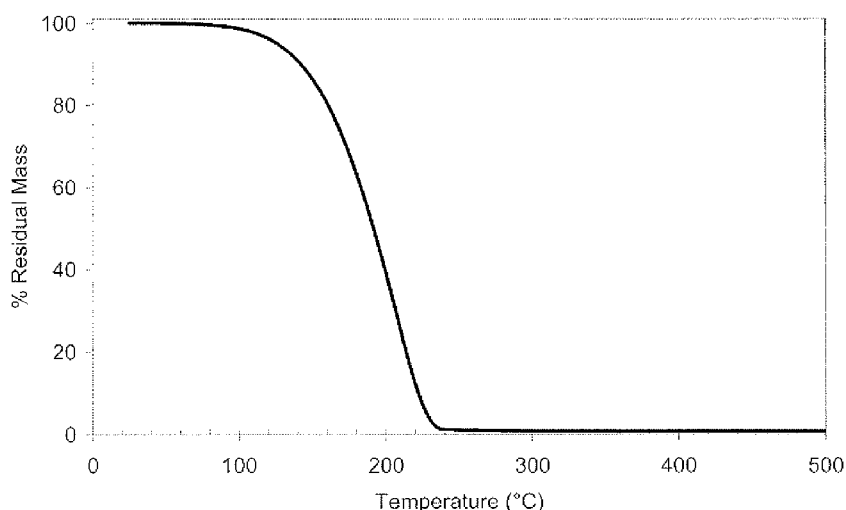


FIG 6

(57) Abstract: Disclosed are titanium-containing precursors and methods of synthesizing the same. The compounds may be used to deposit titanium, titanium oxide, strontium-titanium oxide, and barium strontium titanate containing layers using vapor deposition methods such as chemical vapor deposition or atomic layer deposition.



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## INTERNATIONAL SEARCH REPORT

International application No.  
**PCT/US2011/031346****A. CLASSIFICATION OF SUBJECT MATTER***C23C 16/30(2006.01)i, C23C 16/22(2006.01)i, C23C 16/16(2006.01)i, H01L 21/205(2006.01)i*

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)

C23C 16/30; C23C 16/22; C23C 16/16; H01L 21/205

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)

eKOMPASS(KIPO internal) &amp; Keywords: titanium, alkoxide, amide, diiminate

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	US 6821921 B2 (THEOPOLD, K. H. et al.) 23 November 2004 See formula IA and IB in columns 1, 2, 7, 8.	1,4,5 19-21,23
X	COTTON, S. A. `Titanium, zirconium and hafnium` Annu. Rep. Prog. Chem., Sect. A, 9 August 2001, Vol.97, pp.133-142. See page 135.	14,16
X Y	JP 2006-45083 A (ASAHI DENKA KOGYO KK) 16 February 2006 See paragraphs 16, 33-39, 54-63.	18,22,24,25 19-21,23
A	KR 10-2005-0081302 A (KOREA RESEARCH INSTITUTE OF CHEMICAL TECHNOLOGY) 19 August 2005 See the whole document.	1-25
A	KR 10-0640654 B1 (SAMSUNG ELECTRONICS CO., LTD.) 1 November 2006 See the whole document.	1-25

 Further documents are listed in the continuation of Box C. See patent family annex.

\* Special categories of cited documents:

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"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

"&amp;" document member of the same patent family

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**INTERNATIONAL SEARCH REPORT**

Information on patent family members

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**PCT/US2011/031346**

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 6821921 B2	23.11.2004	AU 1999-25663 A1 CA 2321419 A1 EP 1053260 A1 JP 2002-503733 A WO 99-41290 A1	30.08.1999 19.08.1999 22.11.2000 05.02.2002 19.08.1999
JP 2006-045083 A	16.02.2006	None	
KR 10-2005-0081302 A	19.08.2005	None	
KR 10-0640654 B1	01.11.2006	US 2007-0026688 A1 US 7491654 B2	01.02.2007 17.02.2009