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(54) Title: DEPOSITION OF RUTHENIUM METAL LAYERS IN A THERMAL CHEMICAL VAPOR DEPOSITION PROCESS

(57) Abstract: A method for depositing a Ru metal layer on a substrate is presented. The method includes providing a substrate in a process chamber, introducing a process gas in the process chamber in which the process gas comprises a carrier gas, a ruthenium-carbonyl precursor, and hydrogen. The method further includes depositing a Ru metal layer on the substrate by a thermal chemical vapor deposition process. In one embodiment of the invention, the ruthenium-carbonyl precursor can contain Ru<sub>3</sub>(CO)<sub>12</sub>. and the Ru metal layer can be deposited at a substrate temperature resulting in the Ru metal layer having predominantly Ru(002) crystallographic orientation.



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# INTERNATIONAL SEARCH REPORT

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**A. CLASSIFICATION OF SUBJECT MATTER**

C23C16/18 H01L21/285

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 H01L

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 practical, search terms used)

EPO-Internal, COMPENDEX

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6 074 945 A (VAARTSTRA ET AL) 13 June 2000 (2000-06-13) column 3, line 16 - line 26 and line 38 - line 47; column 4, line 6 - line 10; column 5, line 1 - line 8 and line 48 - line 53; column 6, line 6 - line 12; figure 1	1-38
X	US 2004/105934 A1 (CHANG MEI ET AL) 3 June 2004 (2004-06-03)  paragraphs [0055] - [0057], [0059], [0061], [0073], [0077], [0078]  ----- -/--	1-6, 8-24, 26-38

Further documents are listed in the continuation of Box C.

See patent family annex.

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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.
X	LAI YING-HUI ET AL: "Deposition of Ru and RuO <sub>2</sub> thin films employing dicarbonyl bis-diketonate ruthenium complexes as CVD source reagents" J. MATER. CHEM.; JOURNAL OF MATERIALS CHEMISTRY AUG 1 2003, vol. 13, no. 8, 1 August 2003 (2003-08-01), pages 1999-2006, XP002374189 page 2002 - page 2003; figure 3; table 2 -----	1-36
X	SONG YI-HWA ET AL: "Deposition of conductive Ru and RuO <sub>2</sub> thin films employing a pyrazolate complex [Ru(CO) <sub>3</sub> (3,5-(CF <sub>3</sub> ) <sub>2</sub> -pz)] <sub>2</sub> as the CVD source reagent" ADV MATER; ADVANCED MATERIALS JUN 17 2003, vol. 15, no. 12, 17 June 2003 (2003-06-17), pages 162-169, XP008062200 page 164 - page 165; figure 4; table 1 -----	1-36

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