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12/833,074 9 July 2010 (09.07.2010) US(71) Applicant (for all designated States except US): **MICRON TECHNOLOGY, INC.** [US/US]; 800 South Federal Way, Boise, ID 83716 (US).

(72) Inventor; and

(75) Inventor/Applicant (for US only): **SANDHU, Gurtej, S.** [US/US]; 2964 E. Parkriver Drive, Boise, ID 83706 (US).(74) Agents: **MATKIN, Mark, S.** et al; Wells St. John P.S., 601 West First Avenue, Suite 1300, Spokane, WA 99201 (US).

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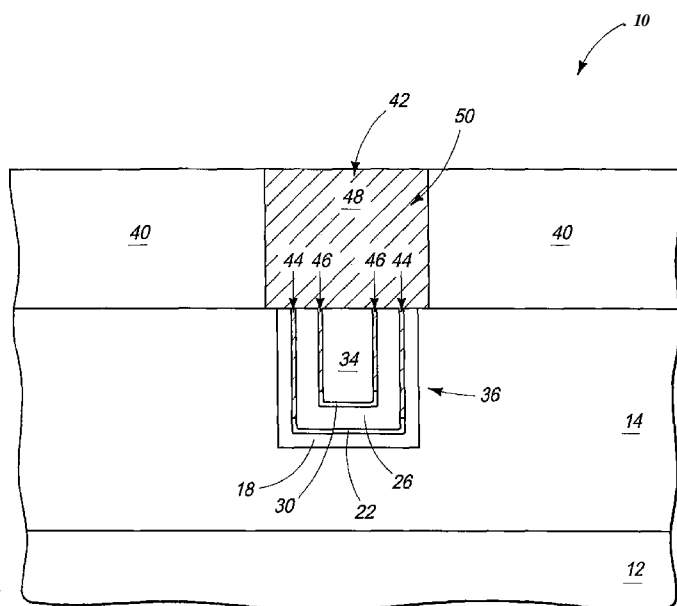
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(54) Title: ELECTRICALLY CONDUCTIVE LAMINATE STRUCTURES, ELECTRICAL INTERCONNECTS, AND METHOD OF FORMING ELECTRICAL INTERCONNECTS



(57) Abstract: Some embodiments include electrical interconnects. The interconnects may contain laminate structures having a graphene region sandwiched between non-graphene regions. In some embodiments the graphene and non-graphene regions may be nested within one another. In some embodiments an electrically insulative material may be over an upper surface of the laminate structure, and an opening may extend through the insulative material to a portion of the laminate structure. Electrically conductive material may be within the opening and in electrical contact with at least one of the non-graphene regions of the laminate structure. Some embodiments include methods of forming electrical interconnects in which non-graphene material and graphene are alternately formed within a trench to form nested non-graphene and graphene regions.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2011/039465**A. CLASSIFICATION OF SUBJECT MATTER****HOIL 21/28(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)

HOIL 21/28; H01R 12/04; HOIL 23/52; HOIL 21/4763; H05K 1/11; HOIL 21/3205; HOIL 21/44

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

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

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

eKOMPASS(KIPO internal) & Keywords: graphene,interconnect,CNT,trench

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2006-0281306 A1 (FLORIAN GSTREIN et al.) 14 December 2006 See abstract; figures 2-6; paragraphs [0019]-[0037]	1-8
A	US 2005-0215049 A1 (MASAHITO HORIBE et al.) 29 September 2005 See abstract; figures 14-15; paragraphs [0141]-[0157]	1-33
A	US 7321097 B2 (MANFRED ENGELHARDT et al.) 22 January 2008 See abstract; figures 6A-6E; column 5 line 14 - column 6 line 11	1-33
A	JP 2006-120730 A (FUJITSU LTD) 11 May 2006 See abstract; figures 2-7; paragraphs [0015]-[0028]	1-33



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Korean Intellectual Property Office
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Kim, Young Jin

Telephone No. 042 481 5771



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Information on patent family members

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2006-0281 306 A1	14.12.2006	CN 10 1208793 AO DE 1 12006001397 T5 GB 0724761 DO GB 2442634 A JP 04-829964 B2 JP 2008-544495 A JP 2008-544495 T KR 10-2008-0009325 A Wo 2006- 133318 A1	25.06,2008 08.05,2008 30.01,2008 09.04,2008 22.09,2011 04.12,2008 04.12,2008 28.01,2008 14.12,2006
US 2005-02 15049 A1	29.09.2005	JP 04-448356 B2 JP 2005-28582 1 A us 2008-0105982 A1 us 7094692 B2 us 7368823 B1	29.01,2010 13.10,2005 08.05,2008 22.08,2006 06.05,2008
US 732 1097 B2	22.01.2008	DE 10006964 A1 DE 10006964 C2 EP 1264344 A1 JP 04-549002 B2 JP 2003-523608 A JP 2003-523608 T KR 10-0494248 B1 TW 503482 B us 2003- 179559 A1 Wo 01-6 1753 A1	13.09,2001 31.01,2002 11.12,2002 16.07,2010 05.08,2003 05.08,2003 13.06,2005 21.09,2002 25.09,2003 23.08,2001
JP 2006- 120730 A	11.05.2006	None	