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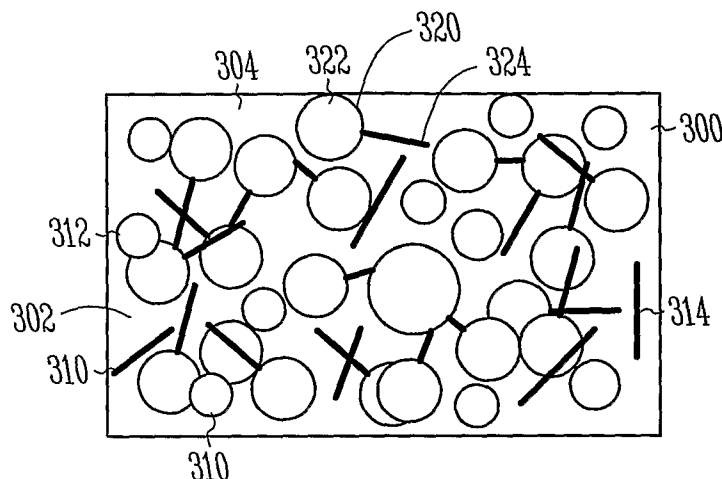
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(54) Title: THERMAL INTERFACE MATERIAL AND METHOD



(57) Abstract: A thermal interface material is provided using composite particles. Advantages include increased thermal conductivity and improved mechanical properties such as lower viscosity. In selected embodiments free particles such as metallic particles or carbon nanotubes, etc. are included in a thermal interface material along with composite particles. An advantage of including free particles along with composite particles includes improved packing density within selected embodiments of thermal interface materials.

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INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER

INV. C09K5/14 H01L23/00

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)

C09K 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, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2005/136248 A1 (LEU CHARLES [US] ET AL) 23 June 2005 (2005-06-23) paragraphs [0013] - [0018] claims	1,2,4,5, 8,10,18, 20,22
A	US 2003/150604 A1 (KONING PAUL A [US] ET AL) 14 August 2003 (2003-08-14) claims	1,2,4-6, 12,15, 18,22
A	US 6 407 922 B1 (ECKBLAD MICHAEL Z [US] ET AL) 18 June 2002 (2002-06-18) claims	1,2,5, 12,15, 18,22
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☒ 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.
A	US 2005/061496 A1 (MATABAYAS JAMES CHRISTOPHER [US]) 24 March 2005 (2005-03-24) paragraphs [0043], [0044] claims	1-8, 18-20,22
A	DE 103 20 838 A1 (ELECTROVAC GESMBH KLOSTERNEUBU [AT]; CURAMIK ELECTRONICS GMBH [DE]) 2 December 2004 (2004-12-02) paragraphs [0020] - [0028] claims	1,18,22
A	US 2005/046017 A1 (DANGELO CARLOS [US] DANGELO CARLOS [US] ET AL) 3 March 2005 (2005-03-03) claims	1-4,12, 18,22
A	US 2005/116336 A1 (CHOPRA NASREEN G [US] ET AL) 2 June 2005 (2005-06-02) claims	1,7,12, 18,22
A	US 2004/266065 A1 (ZHANG YUEGANG [US] ET AL) 30 December 2004 (2004-12-30) claims	1,12,18, 22
P,X	US 2005/139642 A1 (KONING PAUL A [US] ET AL) 30 June 2005 (2005-06-30) the whole document	1,4,6, 18,22

INTERNATIONAL SEARCH REPORT

Information on patent family members

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PCT/US2006/025625

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2005136248 A1	23-06-2005	TW 253467 B	21-04-2006
US 2003150604 A1	14-08-2003	NONE	
US 6407922 B1	18-06-2002	NONE	
US 2005061496 A1	24-03-2005	CN 1853268 A DE 112004001783 T5 KR 20060056394 A TW 241005 B US 2005269726 A1 WO 2005031864 A1	25-10-2006 17-08-2006 24-05-2006 01-10-2005 08-12-2005 07-04-2005
DE 10320838 A1	02-12-2004	CN 1784784 A WO 2004102659 A2 EP 1620892 A2 US 2006263584 A1	07-06-2006 25-11-2004 01-02-2006 23-11-2006
US 2005046017 A1	03-03-2005	US 2006270116 A1	30-11-2006
US 2005116336 A1	02-06-2005	NONE	
US 2004266065 A1	30-12-2004	NONE	
US 2005139642 A1	30-06-2005	NONE	