

(19) World Intellectual Property Organization
International Bureau(43) International Publication Date
20 July 2006 (20.07.2006)

PCT

(10) International Publication Number
WO 2006/076603 A3

(51) International Patent Classification:

H05K 1/09 (2006.01) **C09D 11/00** (2006.01)
H01B 1/22 (2006.01)

(21) International Application Number:

PCT/US2006/001291

(22) International Filing Date: 13 January 2006 (13.01.2006)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:

60/643,578	14 January 2005 (14.01.2005)	US
60/643,577	14 January 2005 (14.01.2005)	US
60/643,629	14 January 2005 (14.01.2005)	US
60/695,405	1 July 2005 (01.07.2005)	US

(71) Applicant (for all designated States except US): **CABOT CORPORATION** [US/US]; TWO SEAPORT LANE, Suite 1300, Boston, Massachusetts 02210-2019 (US).

(72) Inventors; and

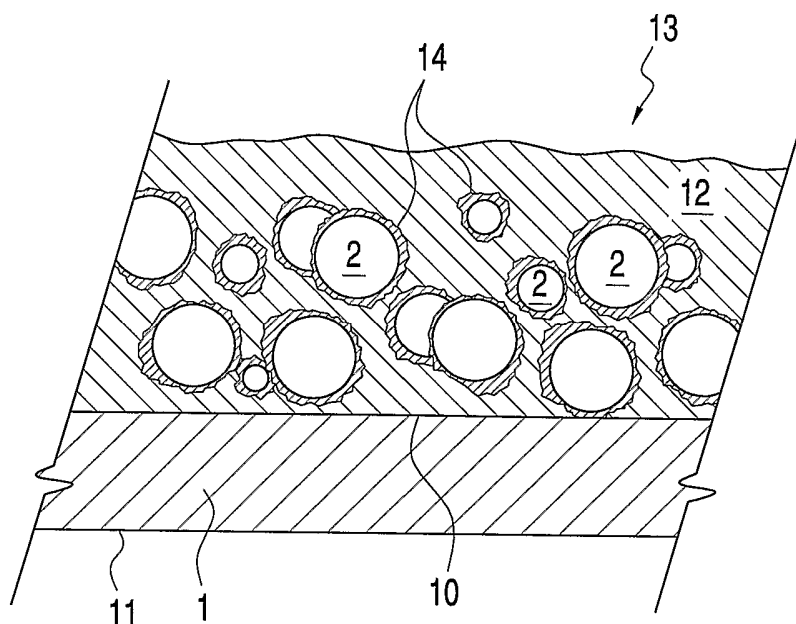
(75) Inventors/Applicants (for US only): **VANHEUSDEN, Karel** [BE/US]; 01 Cielo Grande Drive, Placitas, New Mexico 87043 (US). **KUNZE, Klaus** [DE/US]; 4921 Camino De Monte Ne, Albuquerque, New Mexico 87111 (US). **KIM, Hyungrak** [KR/US]; 6220 Parktree Ne, Albuquerque, New Mexico 87111 (US). **STUMP, Aaron** [US/US]; 724 Marcella St. Ne, Albuquerque, New Mexico 87123 (US). **SCHULT, Allen** [US/US]; 8100-M4 WYOMING BLVD. NE, #188, Albuquerque, New Mexico 87113 (US). **HAMPDEN-SMITH, Mark** [GB/US]; 5808Padre Roberto Nw, Albuquerque, New Mexico 87107 (US). **EDWARDS, Chuck** [US/US]; 2317 Manzano Loop Ne, Rio Rancho, New Mexico 87144 (US). **JAMES, Anthony** [US/US]; 641 Autumn Meadows Dr., Rio Rancho, New Mexico 87144 (US). **CARUSO, James** [US/US]; 7721 Cedar Canyon Court Ne, Albuquerque, New Mexico 87122 (US). **KODAS, Toivo** [US/US]; 11102 San Rafael Ave. Ne, Albuquerque, New Mexico 87122 (US). **HAUBRICH, Scott** [US/US]; 9401 Bobcat Blvd. Ne, Albuquerque, New Mexico 87122 (US). **KOWALSKI, Mark** [US/US]; 9215 Ventura St. Ne, Albuquerque, New Mexico 87122 (US).(74) Agents: **SHER, Jaimes** et al.; CABOT CORPORATION, 5401 Venice Avenue Ne, Albuquerque, New Mexico 87113 (US).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, LY, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM),

[Continued on next page]

(54) Title: PRINTABLE ELECTRICAL CONDUCTORS

(57) Abstract: An electrical conductor formed from one or more metallic inks. The electrical conductor comprises a network of interconnected metallic nodes. Each node comprises a metallic composition, e.g., one or more metals or alloys. The network defines a plurality of pores having an average pore volume of less than about 10,000,000 nm³. The electrical conductors advantageously have a high degree of conductivity, e.g., a resistivity of not greater than about 10x the resistivity of the (bulk) metallic composition, which forms the individual nodes.



European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

- *with international search report*
- *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

(88) Date of publication of the international search report:
16 November 2006

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2006/001291

A. CLASSIFICATION OF SUBJECT MATTER
INV. H05K1/09 H01B1/22 C09D11/00

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)
H05K H01B C09D

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, PAJ, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2004/005413 A (NANOPOWDERS INDUSTRIES LTD; GARBAR, ARKADY; DE LA VEGA, FERNANDO; MATZ) 15 January 2004 (2004-01-15)	1-5, 8-33, 35-38, 42,43
Y	abstract; figure 2; tables 1-3,5 pages 3,4	34
X	US 2003/146019 A1 (HIRAI HIROYUKI) 7 August 2003 (2003-08-07)	1-4,16, 17,20, 21,39-41
	abstract paragraphs [0015], [0016], [0018], [0026], [0027]	
X	WO 03/051562 A (ASAHI KASEI KABUSHIKI KAISHA; MARUYAMA, MUTSUHIRO) 26 June 2003 (2003-06-26)	1-3,6,7, 15-17, 20,21,42
	abstract	
	-/--	

☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"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

"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.

"&" document member of the same patent family

Date of the actual completion of the international search

29 August 2006

Date of mailing of the international search report

26/09/2006

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Heising, S

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2006/001291

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
L,P, X	-& US 2005/069648 A1 (MARUYAMA MUTSUHIRO) 31 March 2005 (2005-03-31) L:translation of PCT application in japanese abstract paragraphs [0001], [0039], [0040], [0059], [0097], [0098], [0118], [0129] -----	1-3,6,7, 15-17, 20,21,42
X	EP 1 339 073 A (HARIMA CHEMICALS, INC; ULVAC, INC) 27 August 2003 (2003-08-27) abstract paragraphs [0016], [0018], [0020], [0053], [0071], [0127] -----	1-7,15, 16
X	EP 1 426 978 A (SUMITOMO ELECTRIC INDUSTRIES, LTD) 9 June 2004 (2004-06-09) abstract; figure 1 paragraph [0225]; table 4 -----	22
X	WO 03/106573 A (NANOPOWDERS INDUSTRIES LTD; GARBAR, ARKADY; DE LA VEGA, FERNANDO; MATZ) 24 December 2003 (2003-12-24) abstract; figures 1-4 pages 14-16 -----	1,22,43
Y	US 2004/191695 A1 (RAY KEVIN BARRY ET AL) 30 September 2004 (2004-09-30)	34
A	paragraph [0026] -----	22
A	US 2004/038808 A1 (HAMPDEN-SMITH MARK J ET AL) 26 February 2004 (2004-02-26) abstract; figure 14 paragraphs [0209] - [0211] -----	8-14, 26-28, 35-37
A	WUELFING W P ET AL: "MONOLAYER-PROTECTED CLUSTERS: MOLECULAR PRECURSORS TO METAL FILMS" CHEMISTRY OF MATERIALS, AMERICAN CHEMICAL SOCIETY, WASHINGTON, US, vol. 13, no. 1, 20 December 2000 (2000-12-20), pages 87-95, XP008015550 ISSN: 0897-4756 -----	1-43
A	US 2004/142165 A1 (FUJII AKIYOSHI ET AL) 22 July 2004 (2004-07-22) -----	1-43
A	PATENT ABSTRACTS OF JAPAN vol. 2000, no. 23, 10 February 2001 (2001-02-10) & JP 2001 167633 A (EBARA CORP), 22 June 2001 (2001-06-22) abstract -----	1-43
	----- -/--	

INTERNATIONAL SEARCH REPORT

International application No

PCT/US2006/001291

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 2003/224104 A1 (FUKUNAGA AKIRA ET AL) 4 December 2003 (2003-12-04) -----	1-43
A	WO 98/08362 A (CRAIG, HUGH, P) 26 February 1998 (1998-02-26) -----	1-43
P,X	US 2005/238804 A1 (GARBAR ARKADY ET AL) 27 October 2005 (2005-10-27) abstract; figures 1-6,8,9,17-22; tables 3,5-7 paragraphs [0021], [0074] -----	1-4, 6-10, 15-18, 20-23, 25, 29-39, 42,43
P,X	US 2005/207930 A1 (YAMAGUCHI YOSHIHIDE) 22 September 2005 (2005-09-22) abstract; figures 1A-1C paragraphs [0088], [0115] -----	1-3,6,7, 15-17, 20,21
E	WO 2006/061557 A (EASTMAN KODAK COMPANY; WINKEL, JURJEN) 15 June 2006 (2006-06-15) abstract paragraph [0039] -----	1,22,43
P,A	EP 1 571 186 A (SUMITOMO ELECTRIC INDUSTRIES, LTD) 7 September 2005 (2005-09-07) -----	
T	MAYO M J ET AL: "Porosity-grain growth relationships in the sintering of nanocrystalline ceramics" FIRST INTERNATIONAL CONFERENCE ON NANOSTRUCTURED MATERIALS 22-26 SEPT. 1992 CANCUN, MEXICO, vol. 3, no. 1-6, 1993, pages 43-52, XP002396734 Nanostructured Materials USA ISSN: 0965-9773 -----	1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2006/001291

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
WO 2004005413	A	15-01-2004	AU 2003237578 A1 CN 1671805 A JP 2005531679 T	23-01-2004 21-09-2005 20-10-2005
US 2003146019	A1	07-08-2003	NONE	
WO 03051562	A	26-06-2003	AU 2002366309 A1 CN 1606481 A DE 10297544 T5 US 2005069648 A1	30-06-2003 13-04-2005 25-11-2004 31-03-2005
US 2005069648	A1	31-03-2005	AU 2002366309 A1 CN 1606481 A DE 10297544 T5 WO 03051562 A1	30-06-2003 13-04-2005 25-11-2004 26-06-2003
EP 1339073	A	27-08-2003	AU 9026601 A CA 2426861 A1 CN 1478285 A WO 0235554 A1 TW 591095 B US 2004004209 A1	06-05-2002 24-04-2003 25-02-2004 02-05-2002 11-06-2004 08-01-2004
EP 1426978	A	09-06-2004	CN 1557000 A WO 03019579 A1 US 2004232386 A1	22-12-2004 06-03-2003 25-11-2004
WO 03106573	A	24-12-2003	AU 2003241128 A1 CN 1668712 A EP 1521811 A1 JP 2005530005 T	31-12-2003 14-09-2005 13-04-2005 06-10-2005
US 2004191695	A1	30-09-2004	NONE	
US 2004038808	A1	26-02-2004	NONE	
US 2004142165	A1	22-07-2004	CN 1525805 A	01-09-2004
JP 2001167633	A	22-06-2001	NONE	
US 2003224104	A1	04-12-2003	NONE	
WO 9808362	A	26-02-1998	AU 3781797 A DE 69710089 D1 DE 69710089 T2 EP 0933010 A1 JP 2000517092 T	06-03-1998 14-03-2002 22-08-2002 04-08-1999 19-12-2000
US 2005238804	A1	27-10-2005	NONE	
US 2005207930	A1	22-09-2005	JP 2005174828 A	30-06-2005
WO 2006061557	A	15-06-2006	NONE	
EP 1571186	A	07-09-2005	US 2005189520 A1	01-09-2005