



(51) International Patent Classification:
C09D 11/00 (2006.01)

(21) International Application Number:
PCT/IL2013/050173

(22) International Filing Date:
28 February 2013 (28.02.2013)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
61/604,605 29 February 2012 (29.02.2012) US

(71) Applicant: YISSUM RESEARCH DEVELOPMENT
COMPANY OF THE HEBREW UNIVERSITY OF
JERUSALEM LTD [IL/IL]; Hi Tech Park, Edmond J.
Safra Campus, Givat Ram, 91390 Jerusalem (IL).

(72) Inventors: GROUCHKO, Michael; 70/5 Tshernichovski
Street, 92585 Jerusalem (IL). MAGDASSI, Shlomo; 36
Hanerd Street, 96626 Jerusalem (IL).

(74) Agent: REINHOLD COHN AND PARTNERS;
P.O.B.13239, 61131 Tel Aviv (IL).

(81) Designated States (unless otherwise indicated, for every
kind of national protection available): AE, AG, AL, AM,
AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY,
BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM,

DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT,
HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP,
KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD,
ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI,
NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU,
RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ,
TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA,
ZM, ZW.

(84) Designated States (unless otherwise indicated, for every
kind of regional protection available): ARIPO (BW, GH,
GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ,
UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ,
TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK,
EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV,
MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM,
TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW,
ML, MR, NE, SN, TD, TG).

Published:

- with international search report (Art. 21(3))
- before the expiration of the time limit for amending the
claims and to be republished in the event of receipt of
amendments (Rule 48.2(h))

(88) Date of publication of the international search report:
5 December 2013

(54) Title: INKS CONTAINING METAL PRECURSORS NANOPARTICLES

(57) Abstract: The present invention provides novel ink formulations based on metal salts and metal complexes.



WO 2013/128449 A3

INTERNATIONAL SEARCH REPORT

International application No

PCT/IL2013/050173

A. CLASSIFICATION OF SUBJECT MATTER

INV. C09D11/00

ADD.

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)

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 practicable, 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	EP 1 847 575 A1 (MITSUI MINING & SMELTING CO [JP]) 24 October 2007 (2007-10-24) examples -----	1-39, 52-58, 60-69, 71,73
X	US 5 814 248 A (TANI HIROJI [JP] ET AL) 29 September 1998 (1998-09-29) examples -----	1-39, 52-58, 60-69, 71,73
X	US 2002/058141 A1 (HAREYAMA YUKIYA [JP]) 16 May 2002 (2002-05-16) examples ----- -/-	1-39, 52-58, 60-69, 71,73



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 application or patent 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

16 May 2013

Date of mailing of the international search report

18/10/2013

Name and mailing address of the ISA/

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

Authorized officer

Schmitz, Volker

INTERNATIONAL SEARCH REPORT

International application No

PCT/IL2013/050173

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	KR 2009 0015634 A (LG CHEMICAL LTD [KR]) 12 February 2009 (2009-02-12) paragraph [0060]; examples -----	1-39, 52-58, 60-69, 71,73
X	WO 2011/079329 A2 (JOANNEUM RES FORSCHUNGSGMBH [AT]; KOESTLER STEFAN [AT]; WACHTER DANIEL) 7 July 2011 (2011-07-07) examples -----	1-39, 52-58, 60-69, 71,73
X,P	EP 2 468 827 A1 (AGFA GEVAERT [BE]) 27 June 2012 (2012-06-27) examples -----	1-39, 52-58, 60-69, 71,73

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IL2013/050173

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

4-12, 19-38(completely); 1-3, 13-18, 39, 52-58, 60-69, 71, 73(partially)

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 4-12, 19-38(completely); 1-3, 13-18, 39, 52-58, 60-69, 71, 73(partially)

A printing formulation (ink) comprising at least one metal precursor in the form of metal salt nanoparticles dispersed in a medium.

2. claims: 40-51(completely); 1-3, 13-18, 39, 52-56, 60-69, 71, 73(partially)

A printing formulation (ink) comprising at least one metal precursor in the form of a metal complex dissolved in a medium, wherein said complex having one or more hydroxy amine or aminoacid complexing moieties.

3. claims: 59(completely); 57(partially)

Method of forming a printing formulation, the method comprising: obtaining a metal precursor in a form of a metal complex, wherein:
when the metal precursor is a metal complex, dissolving the metal complex in a liquid medium.

4. claims: 70(completely); 71(partially)

An element comprising a conductive pattern, wherein said conductive pattern comprises a metallic material being substantially free of metal oxide at the time of manufacture.

5. claims: 72(completely); 73(partially)

An element comprising a conductive pattern, wherein said conductive pattern having high oxidation resistance at ambient atmosphere.

6. claim: 74

A printing formulation comprising at least one metal complex, wherein the at least one metal atom being associated to at least two different organic moieties.

7. claims: 75, 76

A printing formulation comprising at least one metal complex, wherein the at least one metal atom being

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

associated to at least one additive.

8. claim: 77

A printing formulation (ink) comprising a medium and a combination of:

- (1) metal precursor in the form of metal salt nanoparticles dispersed in said medium; and
- (2) metal precursor in the form of a metal complex dissolved in said medium.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/IL2013/050173

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 1847575	A1	24-10-2007	EP 1847575 A1 24-10-2007
			JP 4799881 B2 26-10-2011
			JP 2006210301 A 10-08-2006
			KR 20070097055 A 02-10-2007
			TW I377237 B 21-11-2012
			US 2008134936 A1 12-06-2008
			WO 2006070747 A1 06-07-2006
US 5814248	A	29-09-1998	JP 3419244 B2 23-06-2003
			JP H1055719 A 24-02-1998
			US 5814248 A 29-09-1998
			US 5891283 A 06-04-1999
US 2002058141	A1	16-05-2002	DE 10147304 A1 08-05-2002
			JP 4672125 B2 20-04-2011
			JP 2002104876 A 10-04-2002
			US 2002058141 A1 16-05-2002
KR 20090015634	A	12-02-2009	NONE
WO 2011079329	A2	07-07-2011	AT 509296 A1 15-07-2011
			EP 2513232 A2 24-10-2012
			US 2012256142 A1 11-10-2012
			WO 2011079329 A2 07-07-2011
EP 2468827	A1	27-06-2012	CN 103249786 A 14-08-2013
			EP 2468827 A1 27-06-2012
			KR 20130084299 A 24-07-2013
			WO 2012084813 A1 28-06-2012