(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
30 June 2005 (30.06.2005)

PCT

(10) International Publication Number
WO 2005/059618 A3

(51) International Patent Classification[7]: G03F 7/20

(21) International Application Number:
PCT/EP2004/014290

(22) International Filing Date:
15 December 2004 (15.12.2004)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/530,623 19 December 2003 (19.12.2003) US
60/568,006 4 May 2004 (04.05.2004) US

(71) Applicant *(for all designated States except US)*: **CARL ZEISS SMT AG** [DE/DE]; Carl-Zeiss-Str. 22, 73447 Oberkochen (DE).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: **SCHUSTER, Karl-Heinz** [DE/DE]; Rechbergstr. 24, 89551 Königsbronn (DE). **CLAUSS, Wilfried** [DE/DE]; Lustnauerstr. 39, 72074 Tübingen (DE).

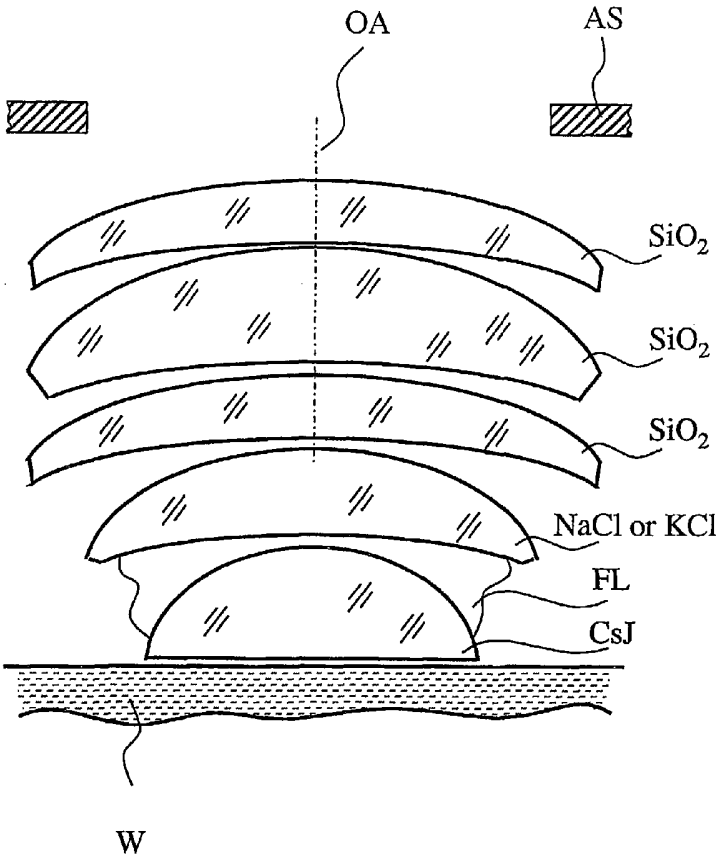
(74) Agent: **MÜLLER-RISSMANN, Werner**; c/o Carl Zeiss AG, Patentabteilung, 73446 Oberkochen (DE).

(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, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, 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), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, 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).

[Continued on next page]

(54) Title: MICROLITHOGRAPHY PROJECTION OBJECTIVE WITH CRYSTAL LENS



(57) Abstract: Very high aperture microlithography projection objectives operating at the wavelengths of 248 nm, 193 nm and also 157 nm, suitable for optical immersion or near-field operation with aperture values that can exceed 1.4 are made feasible with crystalline lenses and crystalline end plates P of NaCl, KCl, KI, RbI, CsI, and MgO, YAG with refractive indices up to and above 2.0. These crystalline lenses and end plates are placed between the system aperture stop AS and the wafer W, preferably as the last lenses on the image side of the objective.

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Declarations under Rule 4.17:

— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii)) for the following designations 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, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, 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, UZ, VC, VN, YU, ZA, ZM, ZW, ARIPO patent (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG)*

— *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii)) for all designations*

— *of inventorship (Rule 4.17(iv)) for US only*

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:
19 January 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

PCT/EP2004/014290

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G03F7/20

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)
IPC 7 G03F

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, INSPEC, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y X	US 2003/174408 A1 (ROSTALSKI HANS-JUERGEN ET AL) 18 September 2003 (2003-09-18) paragraphs [0025], [0036]; figure 3; table 5	1-10 13,14
P,Y	JOHN H. BURNETT ET AL.: "High Index Materials for 193nm and 157nm Immersion Lithography" INTERNATIONAL SEMATECH, 2 August 2004 (2004-08-02), XP001207229 International Symposium on Immersion & 157 nm Lithography, Vancouver cited in the application the whole document	1-10
X	US 2002/102497 A1 (SPARROW ROBERT W) 1 August 2002 (2002-08-01) paragraph [0010]	13,14

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in 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	Date of mailing of the international search report
5 August 2005	10. 11. 05

Name and mailing address of the ISA	Authorized officer
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	Eisner, K

INTERNATIONAL SEARCH REPORT

PCT/EP2004/014290

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 4 861 148 A (SATO ET AL) 29 August 1989 (1989-08-29) column 1, line 59 -----	1
Y	US 6 025 115 A (KOMATSU ET AL) 15 February 2000 (2000-02-15) column 32, line 51 -----	1
A	EP 0 475 020 A (INTERNATIONAL BUSINESS MACHINES CORPORATION) 18 March 1992 (1992-03-18) page 4, line 57 -----	1

INTERNATIONAL SEARCH REPORT

International application No.
PCT/EP2004/014290

Box 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 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 fee, this Authority did not invite payment of any additional fee.

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.:

1-10, 13, 14

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest.

☐ 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: 1-10, 13, 14

prior art: Microlithography projection objective with a numerical aperture larger than 1 and with a lens made from different crystals
special technical feature: Microlithography projection objective with a lens of crystal materials made from NaCl, KCl, KI, NaI, RbI, CsI, MgO, $MgAl_2O_4$ or $Y_3Al_5O_3$.
problem solved by these technical features:
high refraction index material increases the numerical aperture of the objective

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2. claims: 11, 12

special technical feature:
end plate of a microlithography projection objective made from crystalline magensium oxide.
problem solved by these technical features:
protection plate for other optical elements

INTERNATIONAL SEARCH REPORT

PCT/EP2004/014290

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