

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
3 July 2008 (03.07.2008)

PCT

(10) International Publication Number
WO 2008/080127 A3

(51) International Patent Classification:
GOIB 11/00 (2006 01)

(21) International Application Number:
PCT/US2007/088708

(22) International Filing Date:
21 December 2007 (21 12 2007)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/876,748 22 December 2006 (22 12 2006) US

(71) Applicant (for all designated States except US): **ZYGO CORPORATION** [US/US], 21 Laurel Brook Road, Middletown, Connecticut 06455 0448 (US)

(72) Inventors; and

(75) Inventors/Applicants (for US only): **DE LEGA, Xavier Colonna** [US/US], 51 Nutmeg Court, Middletown, Connecticut 06457 (US) **DE GROOT, Peter** [US/US], 355 Laurel Grove Road, Middletown, Connecticut 06457 (US)

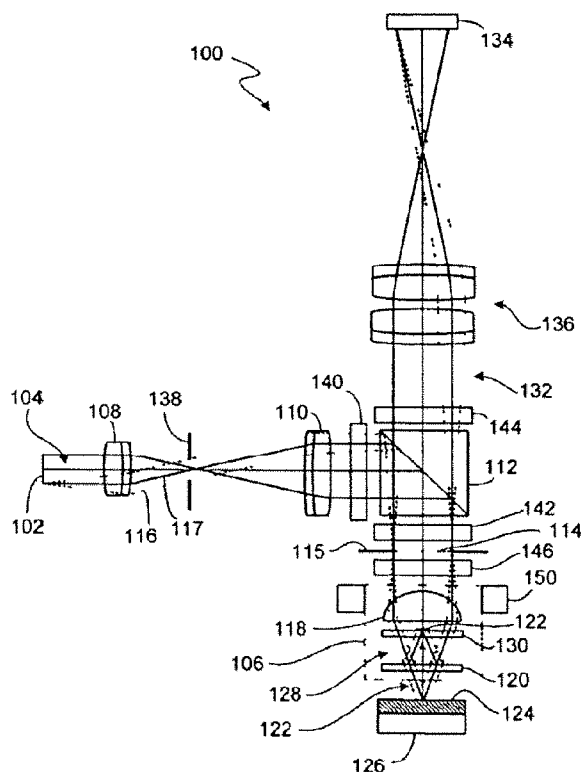
(74) Agent: **BOWLEY, Chris**, Fish & Richardson P C , P O Box 1022, Minneapolis, Minnesota 55440 1022 (US)

(81) Designated States (unless otherwise indicated for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, 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, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, 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, 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, LV, MC, MT, 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: APPARATUS AND METHOD FOR MEASURING CHARACTERISTICS OF SURFACE FEATURES



(57) Abstract: An apparatus is disclosed which includes an interferometry system configured to operate in a first mode to produce a first set of multiple interferometry signals corresponding to different illumination angles of a test object by test light and in a second mode produce a second set of multiple interferometry signals corresponding to different surface locations of a test object. An electronic processor coupled to the interferometry system is configured to receive the first set of interferometry signals and programmed to compare information derivable from the first set of multiple interferometry signals to information corresponding to multiple models of the test object to determine information related to one or features of the test object, and output the information. In some embodiments, the features include an under resolved feature.

WO 2008/080127 A3



Published:

— *with international search report*

(88) Date of publication of the international search report:

4 September 2008

INTERNATIONAL SEARCH REPORT

International application No

PCT/US 07/88708

A CLASSIFICATION OF SUBJECT MATTER

IPC(8) - G01 B 11/00 (2008.04)

USPC - 356/512

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(8) - G01B 11/00 (2008 04)

USPC - 356/512

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

IPC(8) - G01B 11/00 (2008 04) -see keyword below-

USPC -356/451-456, 491, 492, 496-498, 511, 512 -see keyword below-

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

PubWEST(USPT,PGPB,EPAB,JPAB), Google patent, DialogPRO

Search terms - Interferometer, reflectometry, angles, models, iterative regression, ellipsometry, scatterometry, variable, wavelength, reflectivity, non-interferomet π c, detector, stage, illumination, surface, local

C DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No
X	US 7,139,081 B2 (DEGROOT) 21 November 2006 (21 11 2006) Abstract, Figure 11, col 1, ln 26-29, col 1, ln 30-34, col 1, ln 60-66, col 2, ln 26-31, col 2, ln 47-51, col 3, ln 15-19, col 3, ln 22-30, col 3, ln 34-35, col 3, ln 56-60, col 4, ln 12-14, col 4, ln 15-16, col 4, ln 21-25, col 4, ln 26-29, col 4, ln 62-col 5, ln 8, col 5, ln 34-50, col 6, ln 18-23, col 7, ln 65-col 8, ln 3, col 8, ln 8-11, col 8, ln 27-40, col 8, ln 50-52, col 8, ln 53-58, col 8, ln 59-63, col 9, ln 15-19, col 9, ln 56-60, col 10, ln 28-32, col 10, ln 63-67, col 11, ln 52-58, col 12, ln 6-9, col 12, ln 37-47, col 12, ln 55-59, col 13, ln 15-18, col 13, ln 26-28, col 13, ln 42-47	1, 3-17, 19-22, 25-27, 29-31, 33-43, 45-90, 92-97, 99, 101, 102, and 104 2, 18, 23, 24, 28, 32, 44, 91, 98, 100, and 103
Y		2 and 28
Y	US 6,888,638 B1 (HILL) 03 May 2005 (03 05 2005) col 1, ln 66-col 2, ln 8, col 16, ln 51-55	18 and 32
Y	US 6,775,009 B2 (HILL) 10 August 2004 (10 08 2004) col 5, ln 18-20	23 and 24
Y	US 7,012,700 B2 (DEGROOT) 14 March 2006 (14 03 2006) Figure 3, item 170	44, 98, and 100
Y	US 7,038,850 B2 (CHANG et al) 02 May 2006 (02 05 2006) Abstract, col 5, ln 2-4	103
Y	US 2003/0048458 A1 (MIEHER et al) 13 March 2003 (13 03 2003) para [0080]	91
Y	US 7,106,454 B2 (DEGROOT et al) 12 September 2006 (12 09 2006), col 23, ln 24-42	

☐ Further documents are listed in the continuation of Box C

D

* Special categories of cited documents	"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
"A" document defining the general state of the art which is not considered to be of particular relevance	"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
"E" earlier application or patent but published on or after the international filing date	"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
"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)	"&" document member of the same patent family
"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	

Date of the actual completion of the international search 22 May 2008 (22 05 2008)	Date of mailing of the international search report 10 JUN 2008
Name and mailing address of the ISA/US Mail Stop PCT, Attn ISA/US, Commissioner for Patents P O Box 1450, Alexandria, Virginia 22313-1450 Facsimile No 571-273-3201	Authorized officer Lee W Young PCT Helpdesk 571 272-4300 PCT OSP 571 272 7774