

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

(19) World Intellectual Property
Organization
International Bureau

(43) International Publication Date
19 December 2024 (19.12.2024)



(10) International Publication Number
WO 2024/258719 A1

(51) International Patent Classification:

G01N 21/21 (2006.01) G01N 21/956 (2006.01)
G01N 21/25 (2006.01) G01B 11/06 (2006.01)
G01N 21/88 (2006.01) H01L 21/66 (2006.01)
G01N 21/95 (2006.01)

(21) International Application Number:

PCT/US2024/032675

(22) International Filing Date:

05 June 2024 (05.06.2024)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

18/210,558 15 June 2023 (15.06.2023) US

(71) Applicant: **KLA CORPORATION** [US/US]; One Technology Drive, Milpitas, California 95035 (US).

(72) Inventors: **WANG, David Y.**; 1212 Alice Drive, Santa Clara, California 95050 (US). **KRISHNAN, Shankar**; 10723 Pebble Place, Cupertino, California 95014 (US).

(74) Agent: **MCANDREWS, Kevin et al.**; One Technology Drive, Milpitas, California 95035 (US).

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

(54) Title: OPTICS FOR MEASUREMENT OF THICK FILMS AND HIGH ASPECT RATIO STRUCTURES

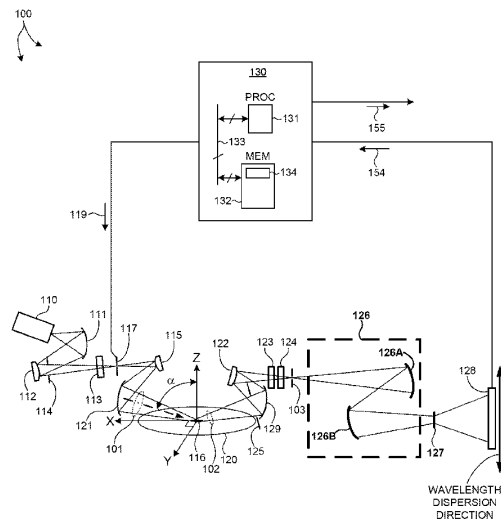


FIG. 1

(57) Abstract: Methods and systems for performing spectroscopic ellipsometry measurements of semiconductor structures with reflective collection relay optics having demagnification from the spectrometer slit to the detector are presented herein. The demagnification effectively increases the NA at the detector and reduces the measurement spot size at the wafer imaged onto the detector. In this manner, the demagnification maintains high spectral resolution at the detector, particularly in the ultraviolet wavelength range, e.g., 120-400 nanometers, while maintaining a small collection NA at the wafer, e.g., collection NA less than 0.05. The small collection NA enables high fringe contrast, signal fidelity, and sensitivity, when measuring thick, multiple layer stacks, e.g., 200-300 layers.

[Continued on next page]

(84) Designated States (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, CV, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SC, SD, SL, ST, 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, ME, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— with international search report (Art. 21(3))