



(51) International Patent Classification:

H01L 21/02 (2006.01) *C23C 16/455* (2006.01)
C23C 16/40 (2006.01) *C07F 7/08* (2006.01)
C23C 16/34 (2006.01)

(21) International Application Number:

PCT/US2022/034513

(22) International Filing Date:

22 June 2022 (22.06.2022)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

17/355,154 22 June 2021 (22.06.2021) US

(71) Applicants: **APPLIED MATERIALS, INC.** [US/US];
 3050 Bowers Avenue, Santa Clara, California 95054 (US).
NATIONAL UNIVERSITY OF SINGAPORE [SG/SG];
 21 Lower Kent Ridge Road, Singapore 119077 (SG).

(72) Inventors: **BARIK, Chandan Kr**; Applied Materials Singapore Technology Pte Ltd, 10 Science park Road, #02-03, The Alpha Science Park II, Singapore 117684 (SG).
YONG, Doreen Wei Ying; Applied Materials Singapore Technology Pte Ltd, 10 Science park Road, #02-03, The Alpha Science Park II, Singapore 117684 (SG). **SUDIJONO**,

John; Applied Materials Singapore Technology Pte Ltd, 10 Science park Road, #02-03, The Alpha Science Park II, Singapore 117684 (SG). **TRINH, Cong**; 3050 Bowers Avenue, Santa Clara, California 95054 (US). **BHUYAN, Bhaskar Jyoti**; 3050 Bowers Avenue, Santa Clara, California 95054 (US). **HAVERTY, Michael**; 3050 Bowers Avenue, Santa Clara, California 95054 (US). **KALIAPPAN, Muthukumar**; 3050 Bowers Avenue, Santa Clara, California 95054 (US). **CHEN, Yingqian**; National University of Singapore, 21 Lower Kent Ridge Road, Singapore 119077 (SG). **TUMMANAPELLI, Anil Kumar**; National University of Singapore, 21 Lower Kent Ridge Road, Singapore 119077 (SG). **WONG, Richard Ming Wah**; National University of Singapore, 21 Lower Kent Ridge Road, Singapore 119077 (SG).

(74) Agent: **WRIGHT, Jonathan B.**; Servilla Whitney LLC, 33 Wood Avenue South, Suite 830, Iselin, New Jersey 08830 (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, 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,

(54) Title: NOVEL OXIDANTS AND STRAINED-RING PRECURSORS

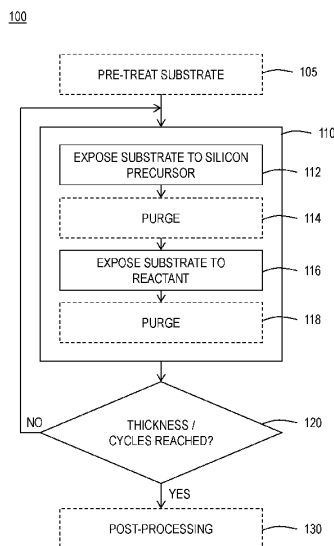


FIG. 1

(57) Abstract: Novel cyclic silicon precursors and oxidants are described. Methods for depositing silicon-containing films on a substrate are described. The substrate is exposed to a silicon precursor and a reactant to form the silicon-containing film (e.g., elemental silicon, silicon oxide, silicon nitride). The exposures can be sequential or simultaneous.

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, 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.

(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, 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, 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))*
- *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))*