

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

(19) World Intellectual Property
Organization
International Bureau

(43) International Publication Date
30 December 2020 (30.12.2020)



(10) International Publication Number
WO 2020/264557 A1

(51) International Patent Classification:

G03F 7/004 (2006.01) G03F 7/20 (2006.01)
G03F 7/16 (2006.01)

(21) International Application Number:

PCT/US2020/070172

(22) International Filing Date:

24 June 2020 (24.06.2020)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

62/868,710 28 June 2019 (28.06.2019) US

(71) Applicant: **LAM RESEARCH CORPORATION**
[US/US]; 4650 Cushing Parkway, Fremont, California
94538 (US).

(72) Inventors: **WEIDMAN, Timothy William**; 4650 Cushing Pkwy., Fremont, California 94538 (US). **GU, Kevin Li**; 4650 Cushing Pkwy., Fremont, California 94538 (US). **NARDI, Katie Lynn**; 5244 Rio Lobo, San Jose, California 95136 (US). **WU, Chenghao**; 4650 Cushing Pkwy., Fremont, California 94538 (US). **VOLOSSKIY, Boris**; 4650 Cushing Pkwy., Fremont, California 94538 (US). **HANSEN, Eric Calvin**; 4650 Cushing Pkwy., Fremont, California 94538 (US).

(74) Agent: **KESICH, Amanda** et al.; Weaver Austin Villeneuve & Sampson LLP, P.O. Box 70250, Oakland, California 94612-0250 (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,

(54) Title: PHOTORESIST WITH MULTIPLE PATTERNING RADIATION-ABSORBING ELEMENTS AND/OR VERTICAL COMPOSITION GRADIENT

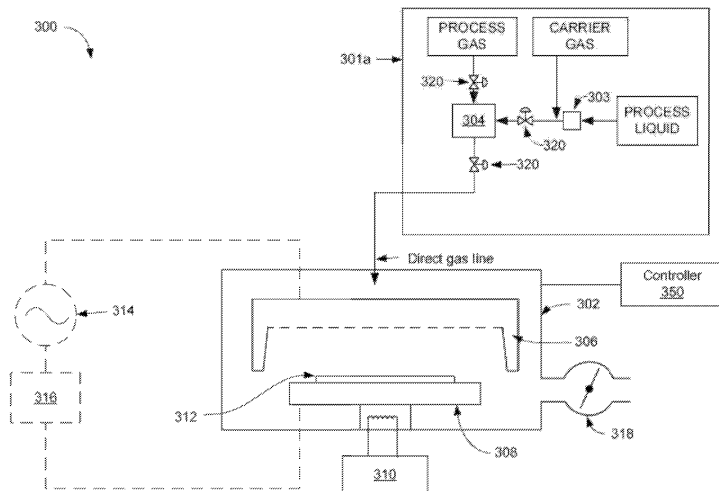


FIG. 3

(57) Abstract: Various embodiments herein relate to techniques for depositing photoresist material on a substrate. For example, the techniques may involve providing the substrate in a reaction chamber; providing a first and second reactant to the reaction chamber, where the first reactant is an organo-metallic precursor having a formula of $M1_aR1_bL1_c$, where: M1 is a metal having a high patterning radiation-absorption cross-section, R1 is an organic group that survives the reaction between the first reactant and the second reactant and is cleavable from M1 under exposure to patterning radiation, L1 is a ligand, ion, or other moiety that reacts with the second reactant, $a \geq 1$, $b \geq 1$, and $c \geq 1$, and where at least one of the following conditions is satisfied: the photoresist material comprises two or more high-patterning radiation absorbing elements, and/or the photoresist material comprises a composition gradient along a thickness of the photoresist material.

[Continued on next page]



WO 2020/264557 A1

HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, 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, 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))*