

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

(19) World Intellectual Property
Organization
International Bureau

(43) International Publication Date
09 September 2022 (09.09.2022)



(10) International Publication Number
WO 2022/187616 A1

- (51) **International Patent Classification:**
C23C 16/08 (2006.01) C23C 16/34 (2006.01)
- (21) **International Application Number:**
PCT/US2022/018899
- (22) **International Filing Date:**
04 March 2022 (04.03.2022)
- (25) **Filing Language:** English
- (26) **Publication Language:** English
- (30) **Priority Data:**
17/193,046 05 March 2021 (05.03.2021) US
- (71) **Applicant: L'AIR LIQUIDE SOCIETE ANONYME POUR L'ETUDE ET L'EXPLOITATION DES PROCEDES GEORGES CLAUDE** [FR/FR]; 75 Quai d'Orsay, 75007 Paris (FR).
- (71) **Applicant (for US only): AMERICAN AIR LIQUIDE, INC.** [US/US]; 46409 Landing Parkway, Fremont, CA 94538 (US).
- (72) **Inventors: LIU, Yumin;** 200 GBC Drive, Newark, DE 19702 (US). **ARTEAGA MULLER, Rocia, Alejandra;** Hikarinooka 2-2, Yokosuka, Kanagawa, 239-0847 (JP). **BLASCO, Nicolas;** 75 Quai d'Orsay, 75007 Paris (FR). **GIRARD, Jean-Marc;** 75 Quai d'Orsay, 75007 Paris (FR). **LI, Feng;** 3040 US Highway 22, Branchburg, NJ 08865 (US). **PALLEM, Vankateswara, R.;** 200 GBC Drive, Newark, DE 19702 (US). **GAO, Zhengning;** Hikarinooka 2-2, Yokosuka, Kanagawa, 239-0847 (JP).

(74) **Agent: YAN, Jiang;** Air Liquide, 9811 Katy Freeway, Suite 100, Houston, TX 77024 (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, IR, IS, IT, JM, 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))

(54) **Title:** REAGENTS TO REMOVE OXYGEN FROM METAL OXYHALIDE PRECURSORS IN THIN FILM DEPOSITION PROCESSES

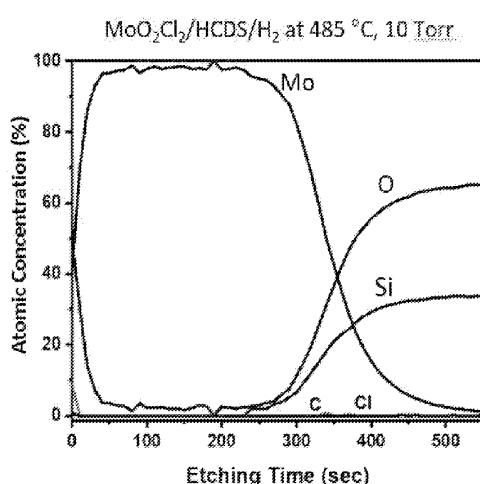


FIG. 2b

(57) **Abstract:** A process for gas phase deposition of a metal or metal nitride film on a surface of substrate comprises: reacting a metal-oxo or metal oxyhalide precursor with an oxophilic reagent in a reactor containing the substrate to deoxygenate the metal-oxo or metal oxyhalide precursor, and forming the metal or metal nitride film on the substrate through a vapor deposition process. The substrate is exposed to the metal oxyhalide precursor and the oxophilic reagent simultaneously or sequentially. The substrate is exposed to a reducing agent sequentially after deoxygenation.

WO 2022/187616 A1