



- (51) **International Patent Classification:**
H01L 21/336 (2006.01) *H01L 29/78* (2006.01)
H01L 21/20 (2006.01)
- (21) **International Application Number:**
PCT/US2015/053195
- (22) **International Filing Date:**
30 September 2015 (30.09.2015)
- (25) **Filing Language:** English
- (26) **Publication Language:** English
- (30) **Priority Data:**
62/072,937 30 October 2014 (30.10.2014) US
- (71) **Applicant:** **APPLIED MATERIALS, INC.** [US/US];
3050 Bowers Avenue, Santa Clara, California 95054 (US).
- (72) **Inventors:** **DUBE, Abhishek**; 733 Old County Road, #G,
Belmont, California 94002 (US). **CHUNG, Hua**; 4645
Piper Drive, San Jose, California 95129 (US). **WANG,
Jenn-Yue**; 1271 Bedford Street, Fremont, California

94539 (US). **LI, Xuebin**; 1030 Castleton Ter. Apt. E,
Sunnyvale, California 94087 (US). **HUANG, Yi-Chiau**;
40972 Cruz Court, Fremont, California 94539 (US). **CHU,
Schubert S.**; 38 Sequoia Way, San Francisco, California
94127 (US).

(74) **Agents:** **PATTERSON, B. Todd** et al.; Patterson &
Sheridan, L.L.P., 24 Greenway Plaza, Suite 1600, Houston,
Texas 77046 (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, DK, DM,
DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT,
HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR,
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, SM, ST, SV, SY, TH, TJ, TM, TN,
TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

[Continued on next page]

(54) **Title:** METHOD TO GROW THIN EPITAXIAL FILMS AT LOW TEMPERATURE

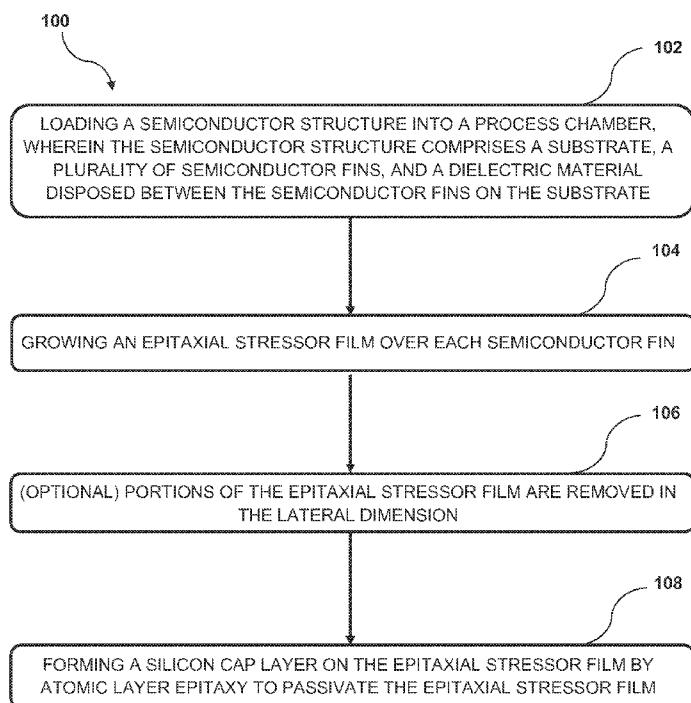


FIG. 1

(57) **Abstract:** Implementations of the present disclosure generally relate to methods for epitaxial growth of a silicon material on an epitaxial film. In one implementation, the method includes forming an epitaxial film over a semiconductor fin, wherein the epitaxial film includes a top surface having a first facet and a second facet, and forming an epitaxial layer on at least the top surface of the epitaxial film by alternately exposing the top surface to a first precursor gas comprising one or more silanes and a second precursor gas comprising one or more chlorinated silanes at a temperature of about 375°C to about 450°C and a chamber pressure of about 5 Torr to about 20 Torr.



(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))