



(51) International Patent Classification:

C23C 16/40 (2006.01) B05D 1/00 (2006.01)
C23C 16/50 (2006.01) C07F 7/18 (2006.01)
H01L 21/02 (2006.01)

(21) International Application Number:

PCT/US2022/077912

(22) International Filing Date:

11 October 2022 (11.10.2022)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:

63/255,323 13 October 2021 (13.10.2021) US

(71) Applicant: **VERSUM MATERIALS US, LLC** [US/US];
8555 South River Parkway, Tempe, Arizona 85284 (US).

(72) Inventors: **MACDONALD, Matthew R.**; Versum Materials US, LLC, 8555 South River Parkway, Tempe, Arizona 85284 (US). **LEI, Xinjian**; Versum Materials US, LLC,

8555 South River Parkway, Tempe, Arizona 85284 (US).
FOODY, Michael James; Versum Materials US, LLC,
8555 South River Parkway, Tempe, Arizona 85284 (US).

(74) Agent: **BENSON, David K.**; Versum Materials US, LLC,
8555 South River Parkway, Tempe, Arizona 85284 (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, 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,

(54) Title: ALKOXYSILANES AND DENSE ORGANOSILICA FILMS MADE THEREFROM

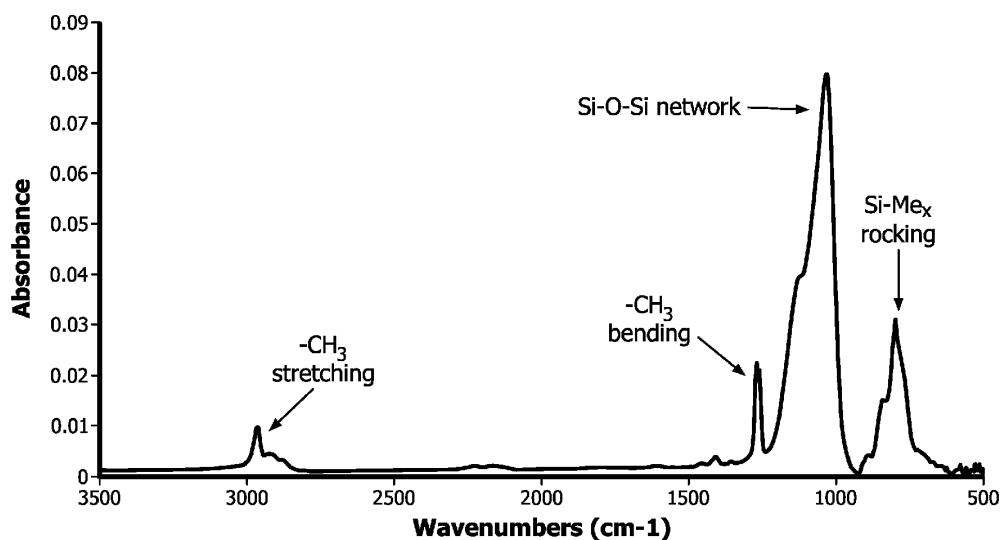


Figure 1

(57) Abstract: A method for making a dense organosilicon film with improved mechanical properties includes the steps of: providing a substrate within a reaction chamber; introducing into the reaction chamber a gaseous composition comprising alkoxyasilane; and applying energy to the gaseous composition comprising alkoxyasilane in the reaction chamber to induce reaction of the gaseous composition comprising alkoxyasilane to deposit an organosilicon film on the substrate, wherein the organosilicon film has a dielectric constant of from ~ 2.40 to ~ 3.20, an elastic modulus of from ~ 6 to ~ 30 GPa, and an at. % carbon of from ~ 10 to ~ 45 as measured by XPS.

[Continued on next page]

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, 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))