

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

(19) World Intellectual Property
Organization
International Bureau

(43) International Publication Date
13 April 2023 (13.04.2023)



(10) International Publication Number
WO 2023/059999 A1

(51) International Patent Classification:

C09G 1/02 (2006.01) H01L 21/67 (2006.01)
C09K 3/14 (2006.01) B24B 37/04 (2006.01)
H01L 21/3105 (2006.01)

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).

(21) International Application Number:

PCT/US2022/077064

(22) International Filing Date:

27 September 2022 (27.09.2022)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

63/252,425 05 October 2021 (05.10.2021) US

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

(72) Inventors: **ZHOU, Hongjun**; 8555 South River Parkway,
Tempe, Arizona 85284 (US). **MURELLA, Krishna P.**;
8555 South River Parkway, Tempe, Arizona 85284 (US).
SHI, Xiaobo; 8555 South River Parkway, Tempe, Arizona
85284 (US). **ROSE, Joseph D.**; 8555 South River Parkway,
Tempe, Arizona 85284 (US).

(74) Agent: **YANG, Lina**; Versum Materials US, LLC, 7350
Tilghman Street, Suite 104, Allentown, Pennsylvania
18106-9000 (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, 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,

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))

WO 2023/059999 A1

(54) Title: CHEMICAL MECHANICAL PLANARIZATION POLISHING FOR SHALLOW TRENCH ISOLATION

(57) Abstract: The present invention discloses Shallow Trench Isolation (STI) Chemical Mechanical Planarization (CMP) polishing compositions, methods and systems that offer high and tunable Oxide: SiN and Oxide: Poly-Si removal selectivity, and low oxide trench dishing at different pH conditions in addition to suppressed Poly-Si removal rates. The polishing compositions comprise abrasive particles such as calcined ceria, and at least two preferably at least three chemical additives. The additives are (1) chemicals such as D-mannose, L-mannose, ribitol (D-ribitol), xylitol, meso-erythritol, D-sorbitol, mannitol, dulcitol, iditol, maltitol, fructose, sorbitan, sucrose, D-ribose, inositol, and glucose; (2) polyacrylic acid or polyacrylate and its ammonium, potassium or sodium salt, and (3) polyethylene glycol (PEG) with different molecular weight distributions as film selectivity tuning and oxide trench dishing reducing additives.