

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

(19) World Intellectual Property
Organization
International Bureau

(43) International Publication Date
21 September 2023 (21.09.2023)



(10) International Publication Number
WO 2023/178210 A1

(51) International Patent Classification:
C01B 33/16 (2006.01)

(21) International Application Number:
PCT/US2023/064484

(22) International Filing Date:
15 March 2023 (15.03.2023)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
63/320,600 16 March 2022 (16.03.2022) US

(71) Applicant: **W.R. GRACE & CO.-CONN** [US/US]; 7500
Grace Drive, Columbia, Maryland 21044 (US).

(72) Inventors: **XU, Linping**; c/o W. R. Grace & Co.-Conn.,
7500 Grace Drive, Columbia, Maryland 21044 (US).
CHAPMAN, Dave; c/o W. R. Grace & Co.-Conn., 7500
Grace Drive, Columbia, Maryland 21044 (US). **ZHANG,
Li**; c/o W. R. Grace & Co.-Conn., 7500 Grace Drive, Co-
lumbia, Maryland 21044 (US). **BAPTISTE, Michael**; c/o
W. R. Grace & Co.-Conn., 7500 Grace Drive, Columbia,
Maryland 21044 (US). **KRINSKY, Jamin L.**; c/o W. R.
Grace & Co.-Conn., 7500 Grace Drive, Columbia, Mary-
land 21044 (US). **HAIN, JR., John H.**; c/o W. R. Grace &
Co.-Conn., 7500 Grace Drive, Columbia, Maryland 21044
(US).

(74) Agent: **LOMPREY, Jeffrey** et al.; 3000 K Street, N.W.,
Suite 600, Washington, District of Columbia 20007 (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, MU, 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, CV,
GH, GM, KE, LR, LS, MW, MZ, NA, RW, SC, 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).

Declarations under Rule 4.17:

— *as to applicant's entitlement to apply for and be granted a
patent (Rule 4.17(ii))*

Published:

— *with international search report (Art. 21(3))*

WO 2023/178210 A1

(54) Title: PROCESS FOR PRODUCING POROUS SPHERICAL SILICA GEL PARTICLES

(57) Abstract: A process for forming a porous spherical silica material is provided. The process comprises mixing an alkali silicate with a mineral acid at pH and temperature sufficient to form a silica sol, mixing the silica sol with an oil and a surfactant to form a water-in-oil type emulsion, adding an alkaline solution to the emulsion to form a gel, adding a demulsifying agent and heating to a temperature of from about 60°C to about 90°C, and filtering, washing, optionally aging, and drying to obtain the porous spherical silica gel particles.