

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

(19) World Intellectual Property
Organization
International Bureau

(43) International Publication Date
18 February 2021 (18.02.2021)



(10) International Publication Number
WO 2021/030529 A1

(51) International Patent Classification:

C04B 7/42 (2006.01) C04B 7/06 (2006.01)
C04B 7/36 (2006.01) C04B 2/06 (2006.01)
C04B 7/43 (2006.01)

Pasadena, California 91125 (US). **BRIMSTONE ENERGY INC.** [US/US]; 557 59th St., Oakland, California 94609 (US).

(21) International Application Number:

PCT/US2020/046063

(72) **Inventors:** **FINKE, Cody E.**; c/o Brimstone Energy Inc., 557 59th St., Oakland, California 94609 (US). **LEANDRI, Hugo F.**; c/o California Institute of Technology, 1200 E. California Blvd., M/C 6-32, Pasadena, California 91125 (US).

(22) International Filing Date:

13 August 2020 (13.08.2020)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

62/886,137	13 August 2019 (13.08.2019)	US
62/913,620	10 October 2019 (10.10.2019)	US
62/932,200	07 November 2019 (07.11.2019)	US
63/019,916	04 May 2020 (04.05.2020)	US

(74) **Agent:** **CHERNOMORDIK, Boris D.** et al.; 4940 Pearl East Circle, Suite 200, Boulder, Colorado 80301 (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, 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,

(71) **Applicants:** **CALIFORNIA INSTITUTE OF TECHNOLOGY** [US/US]; 1200 E. California Blvd., M/C 6-32,

(54) **Title:** PROCESS TO MAKE CALCIUM OXIDE OR ORDINARY PORTLAND CEMENT FROM CALCIUM BEARING ROCKS AND MINERALS

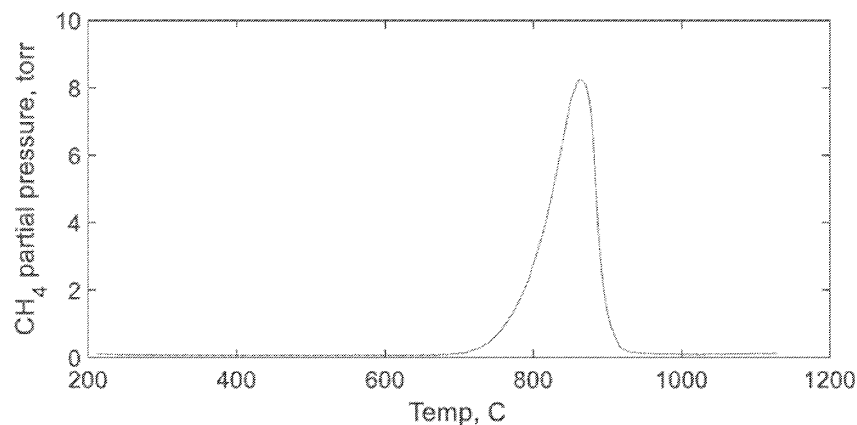


FIG. 1

(57) **Abstract:** Aspects of the invention include a method of producing a cement material comprising step of: first reacting a calcium-bearing starting material with a first acid to produce an aqueous first calcium salt; second reacting the aqueous first calcium salt with a second acid to produce a solid second calcium salt; wherein the second acid is different from the first acid and the second calcium salt is different from the first calcium salt; and thermally treating the second calcium salt to produce a first cement material. Preferably, but not necessarily, during the second reacting step, reaction between the first calcium salt and the second acid regenerates the first acid.

[Continued on next page]

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))