

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

(19) World Intellectual Property
Organization
International Bureau

(43) International Publication Date
27 March 2025 (27.03.2025)



(10) International Publication Number
WO 2025/064393 A1

(51) International Patent Classification:

C01B 39/02 (2006.01) *C01B 39/20* (2006.01)
B01J 29/08 (2006.01) *C01B 39/24* (2006.01)

(21) International Application Number:

PCT/US2024/047024

(22) International Filing Date:

17 September 2024 (17.09.2024)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

18/470,076 19 September 2023 (19.09.2023) US

(71) Applicants: **SAUDI ARABIAN OIL COMPANY** [SA/SA]; Post Office Box 5000, Dhahran, 31311 (SA). **KING ABDULLAH UNIVERSITY OF SCIENCE AND TECHNOLOGY** [SA/SA]; 4700 King Abdullah University of Science and Technology, Thuwal, 23955-6900 (SA).

(71) Applicant (for AG only): **ARAMCO SERVICES COMPANY** [US/US]; 1200 Smith Street, Two Allen Building, Houston, Texas 77002 (US).

(72) Inventors: **HODGKINS, Robert Peter**; c/o Saudi Arabian Oil Company, Post Office Box 5000, Dhahran, 31311 (SA). **KOSEOGLU, Omer Refa**; c/o Saudi Arabian Oil Company, Post Office Box 5000, Dhahran, 31311 (SA). **HUANG, Kuo-Wei**; c/o King Abdullah University of Science and Technology, 4700 King Abdullah University of Science and

Technology, Thuwal, 23955-6900 (SA). **RUEPING, Magnus**; c/o King Abdullah University of Science and Technology, 4700 King Abdullah University of Science and Technology, Thuwal, 23955-6900 (SA). **SEDJERARI, Anissa Bendjeriou**; c/o King Abdullah University of Science and Technology, 4700 King Abdullah University of Science and Technology, Thuwal, 23955-6900 (SA). **PARSA PUR, Rajesh Kumar**; c/o King Abdullah University of Science and Technology, 4700 King Abdullah University of Science and Technology, Thuwal, 23955-6900 (SA). **PANDEY, Swechchha**; c/o King Abdullah University of Science and Technology, 4700 King Abdullah University of Science and Technology, Thuwal, 23955-6900 (SA).

(74) Agent: **HENDERSON, Luke A.** et al.; Dinsmore & Shohl LLP, One South Main Street, Suite 1300, Dayton, Ohio 45402 (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.

(54) Title: MODIFIED ZEOLITES THAT INCLUDE AMINE FUNCTIONALITIES AND METHODS FOR MAKING SUCH

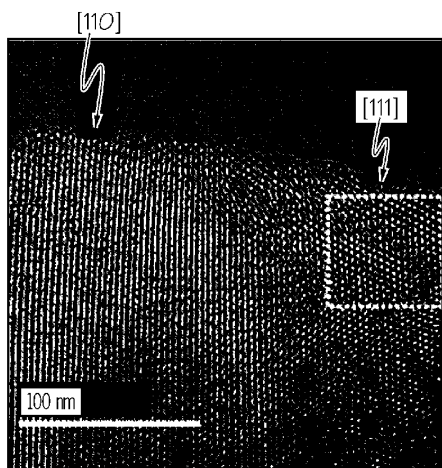


FIG. 1A

(57) Abstract: Modified zeolite may include a microporous framework including a plurality of micropores having diameters of less than or equal to 2 nm, wherein the microporous framework includes at least silicon atoms and oxygen atoms; a plurality of mesopores having diameters of greater than 2 nm and less than or equal to 50 nm, wherein the plurality of mesopores are ordered with cubic symmetry. The modified zeolite also includes: isolated terminal primary amine functionalities bonded to silicon atoms of the microporous framework; or silazane functionalities, wherein the nitrogen atom of the silazane bridges two silicon atoms of the microporous framework; or both.

WO 2025/064393 A1

[Continued on next page]

(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))*
- *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*

Published:

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