

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

(19) World Intellectual Property  
Organization  
International Bureau

(43) International Publication Date  
11 January 2024 (11.01.2024)



(10) International Publication Number  
**WO 2024/011046 A1**

(51) International Patent Classification:

C01B 39/02 (2006.01) C10G 47/16 (2006.01)  
C01B 39/06 (2006.01) C10G 47/20 (2006.01)  
C01B 39/20 (2006.01)

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.

(21) International Application Number:

PCT/US2023/069243

(22) International Filing Date:

28 June 2023 (28.06.2023)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

17/857,572 05 July 2022 (05.07.2022) US

(71) Applicants: SAUDI ARABIAN OIL COMPANY  
[SA/SA]; 1 Eastern Avenue, Dhahran, 31311 (SA).  
KING ABDULLAH UNIVERSITY OF SCIENCE AND  
TECHNOLOGY [SA/SA]; 4700 King Abdullah University  
of Science and Technology, Thuwal, 23955-6900 (SA).

(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).

Published:

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

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

(72) Inventors: PARSAPUR, Rajesh Kumar; c/o King Ab-  
dullah University of Science and Technology, 4700 King  
Abdullah University of Science and Technology, Thuw-  
al, 23955-6900 (SA). HODGKINS, Robert Peter; c/o  
Saudi Arabian Oil Company, 1 Eastern Avenue, Dhahran,  
31311 (SA). KOSEOGLU, Omer Refa; c/o Saudi Ara-  
bian Oil Company, 1 Eastern Avenue, 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). SED-  
JERARI, Anissa Bendjeriou; c/o King Abdullah Universi-  
ty of Science and Technology, 4700 King Abdullah Univer-  
sity of Science and Technology, Thuwal, 23955-6900 (SA).

(74) Agent: CRISPINO, Ralph J. et al.; One Barker Avenue,  
Fifth Floor, White Plains, New York 10601 (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,

(54) Title: HIERARCHICALLY ORDERED CRYSTALLINE MICROPOROUS MATERIALS WITH LONG-RANGE MESO-  
POROUS ORDER HAVING LAMELLAR SYMMETRY

(57) Abstract: A composition of matter is provided comprising hierarchically ordered crystalline microporous material having well-  
defined long-range mesoporous ordering of lamellar symmetry. The composition possesses mesopores having walls of crystalline  
microporous material and a mass of mesostructure between mesopores of crystalline microporous material. Long-range ordering is  
defined by presence of secondary peaks in an X-ray diffraction (XRD) pattern and/or lamellar symmetry observable by microscopy.

WO 2024/011046 A1