



- (51) **International Patent Classification:**
C01B 32/15 (2017.01) *C09C 1/48* (2006.01)
- (21) **International Application Number:**
PCT/US2022/082122
- (22) **International Filing Date:**
21 December 2022 (21.12.2022)
- (25) **Filing Language:** English
- (26) **Publication Language:** English
- (30) **Priority Data:**
63/292,592 22 December 2021 (22.12.2021) US
63/379,308 13 October 2022 (13.10.2022) US
- (71) **Applicant:** NABORS ENERGY TRANSITION SOLUTIONS LLC [US/US]; 515 West Greens Road, Suite 1200, Houston, Texas 77067 (US).
- (72) **Inventors:** JOHNSON, Evan; 66 Red Sable Drive, Spring, Texas 77380 (US). YOLLIN, Paul; 6 Whispering Thicket Place, Tomball, Texas 77375 (US). COOK, Dylan; 25202 Summer Chase Drive, Spring, Texas 77389 (US).
- (74) **Agent:** HAMILTON, Brett, A. et al.; 12414 Alderbrook Drive, Suite 201, Austin, Texas 78758 (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, 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, 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).

(54) **Title:** CARBON-BASED NANOMATERIAL COMPOSITION AND METHODS OF FORMING THE SAME FROM A GAS MIXTURE THAT INCLUDES HYDROGEN GAS AND OXYGEN GAS

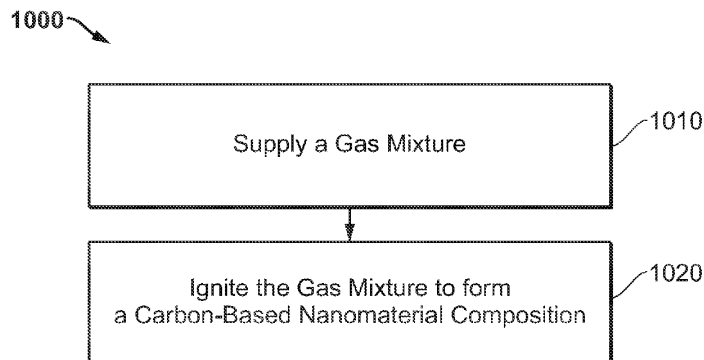


FIG. 1

(57) **Abstract:** The present disclosure relates to a carbon-based nanomaterial composition that may be formed from a gas mixture. The gas mixture may include acetylene gas at a molar ratio AG_{mol}/GM_{mol} of at least about 0.20 and not greater than about 0.99, oxygen gas at a molar ratio OG_{mol}/GM_{mol} of at least about 0.1 and not greater than about 0.85, and hydrogen gas at a molar ratio HG_{mol}/GM_{mol} of at least about 0.00 and not greater than about 0.99. The carbon-based nanomaterial composition may have a carbon hybridization ratio P_{sp3}/P_{sp2} of not greater than about 5.0, where P_{sp3} is the percent of carbon within the carbon-based nanomaterial composition having a sp^3 hybridization and P_{sp2} is the percent of carbon within the carbon-based nanomaterial composition having a sp^2 hybridization.

[Continued on next page]

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))*
- *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))*