

(43) International Publication Date  
29 December 2011 (29.12.2011)(10) International Publication Number  
**WO 2011/162727 A1**

## (51) International Patent Classification:

**C01B 31/04** (2006.01) **B82Y 20/00** (2011.01)  
**B82Y 15/00** (2011.01)

## (21) International Application Number:

PCT/SG2011/000225

## (22) International Filing Date:

24 June 2011 (24.06.2011)

## (25) Filing Language:

English

## (26) Publication Language:

English

## (30) Priority Data:

61/398,468 25 June 2010 (25.06.2010) US

(71) Applicant (for all designated States except US): **NATIONAL UNIVERSITY OF SINGAPORE** [SG/SG];  
21 Lower Kent Ridge Road, Singapore 119077 (SG).

## (72) Inventors; and

(75) Inventors/Applicants (for US only): **LOH, Kian, Ping** [SG/SG]; c/o National University of Singapore, Faculty of Science, Department of Chemistry, 21 Lower Kent Ridge Road, Singapore 119077 (SG). **WANG, Junzhong** [CN/SG]; c/o National University of Singapore, NUS Nanoscience and Nanotechnology Initiative, 21 Lower Kent Ridge Road, Singapore 119077 (SG).(74) Agent: **AMICA LAW LLC**; 30 Raffles Place, #18-03/04 Chevron House, Singapore 048622 (SG).

(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, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, 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, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, 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, ML, MR, NE, SN, TD, TG).

## Declarations under Rule 4.17:

— of inventorship (Rule 4.17(iv))

## Published:

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

(54) Title: METHODS OF FORMING GRAPHENE BY GRAPHITE EXFOLIATION

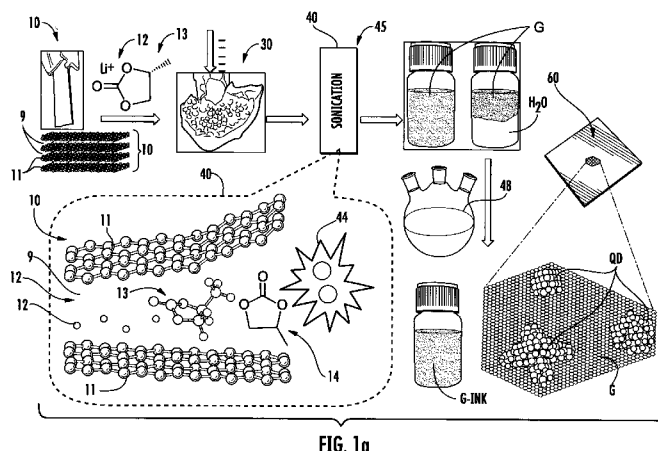


FIG. 1a

(57) Abstract: Methods of forming graphene (G) by graphite exfoliation, wherein the methods include: providing a graphite sample (10) having atomic layers (11) of carbon; introducing a salt (12) and a solvent (14) into the space (9) between the atomic layers; expanding the space between the atomic layers using organic molecules and ions from the solvent and the salt; and separating the atomic layers using a driving force (45) to form one or more sheets of graphene. The graphene produced by the methods can be used to form solar cells (70), to perform DNA analysis, and for other electrical, optical and biological applications.