Journal of Basic and Applied Engineering Research
Print ISSN: 2350-0077; Online ISSN: 2350-0255; Volume 2, Number 13; April-June, 2015 pp. 1167-1167

http://www.krishisanskriti.org/jbaer.html

Malonic Acid Mediated Synthesis of One Atom Thick Graphene Sheets and its Supercapacitor Applications

Anil Kumar[1] and Mahima Khandelwal[2]

[1,2]Department of Chemistry, Indian Institute of Technology Roorkee, Roorke-247667, India

Abstract—*We have employed malonic acid, as a reducing agent, to synthesize one atom thick graphene sheets (GRH-MA) under mild pH and thermal conditions. The formation of ultrathin graphene sheets was characterized by using AFM, FESEM and TEM analysis. AFM study shows its thickness to be 0.41 ± 0.03 nm. XPS analysis suggested the effective reduction of graphene oxide (GO) to GRH-MA. Annealing of GRH-MA at a mild temperature of 300 ^{0}C (GRH-MA300) further increases the sp^2 character as revealed by the ^{13}C NMR studies following the order: GO < GRH-MA < GRH-MA300. The increase in conductivity also evidenced the same order. XRD and HRTEM analysis of GRH-MA300 exhibits a reduced 'd' spacing of 0.350 nm as compared to that of 0.363 for GRH-MA, with hexagonal structure. It thus indicated the formation of more ordered graphitic structure upon annealing. The efficient reduction by malonic acid has been attributed to the presence of active methylene group, which makes it as an effective nucleophile. In cyclic voltammetry, GRH-MA shows fairly high specific capacitance (C_s) of 173 F/g, which is more than 23 fold higher to that of GO (7.5 F/g) at 100 mV/s in 1 M H_2SO_4. Galvanostatic charge-discharge measurements shows the maximum C_s value of 254 F/g at 1 A/g which is more than an order of magnitude higher to that of GO (18.6 F/g). Moreover, long charge discharge cycles of this electrode material at 10A/g demonstrates its immense potential for supercapacitor applications.*