Research Article **Available online www.ijsrr.org** **ISSN: 2279–0543**

International Journal of Scientific Research and Reviews

Solar Mediated Synthesis Graphene Oxide and Its Structural, Morphological Properties

Subramani Shanmugam[1] and Sivanandan Nanjan[1]*

[1]Department of Electronics, PSG College of Arts and Science, Coimbatore- 641014, India.

ABSTRACT

At the present study,Thegraphene oxide (GO) was prepared by Hummer's modified method. The reduced graphene oxide (rGO) was prepared by solar mediated.Graphene (G) is a newcomer material that holds promising properties for structural , morphological. The production of high quality growth a good yield is a long-standing goal forreduced graphene oxide. The structural and morphology properties investigated and carriedoutof X-ray diffraction (XRD), Field- emission scanning electron microscopy (FESEM), Energy-dispersive X-ray spectroscopy (EDS), Fourier transform infrared spectroscopy (FTIR) and Raman spectroscopy. This simple and costeffectmothodrGO prepared for fabrication of various electronic storage devices.

KEYWORDS:- Graphene oxide, Structural, Nanosheets, Oxidation, Raman.

***Corresponding Author**

Dr.N.Sivanandan

Department of Electronics,
Assistant Professor,
PSG College of Arts and Science,
Coimbatore – 641014, Tamilnadu, India.
Email :sivanandannanjan@gmail.com, Mob No – 9994165221

1. INTRODUCTION

In the last few decades, the great interest that surely preludes a way to search on Graphene oxide materials are in allotrope of carbon with two dimensional honeycomb sp^2 crystalline lattice[1]. The orthorhombic atomic structure of graphene is able to supply a building platform for the epitaxial growth of nanostructures. Graphene oxide (GO) is derived from chemical oxidation of graphene and oxidation of Graphite Graphene (GN), an allotrope of carbon material, conquered the world of nanotechnology in the last decade because of its unique properties. Among the techniques, electrochemical method was reported as a reliable and low cost method to produce highly pure graphene[2]. Carbon materials have been precise as the most favored electrode materials, due to their high electrical conductivity, chemical stability, large accessible surface area. So far, several well-developed porous carbons with different morphologies have been extensively investigated, such as porous carbon nanospheres, carbon nanopowers, carbon nanosheets, carbon nanofibers, graphene, graphite foams and so on. Graphene and carbon nanosheets, are of great potential as electrode materials. owing to some of unique properties, large surface area and porous layer structure[3,4]. Moreover, the synthetic process of graphene is relatively complicated and high-cost, which violates the requirements of easy operation, high acquiesce and high excellence in the usefulindustrializedapplications[5].

2. MATERIAL SYNTHESIS AND EXPERIMENTAL TECHNIQUE

GO was synthesized from graphite powder using Hummer's method[6]. The reduced GO was prepared using a convex lens of 100 mm diameter to focus solar radiation [7,9].

RESULTS AND DISCUSSION

3. XRD ANALYSIS

The XRD pattern of synthesisd GO/rGO with diffraction with Cu Kα radiation (λ=1.54178 Å). are depicted in Fig. 1(a) and (b)shows GO/rGO exhibited a well-crystalline orthorhombic crystal type of the structure (JCPDS card no:89-8491). All the samples of GO/rGO featured sharp diffraction peaks indicate that GO at 11.83, 42.78 with corresponds that (001) and (100) the peaks [10].

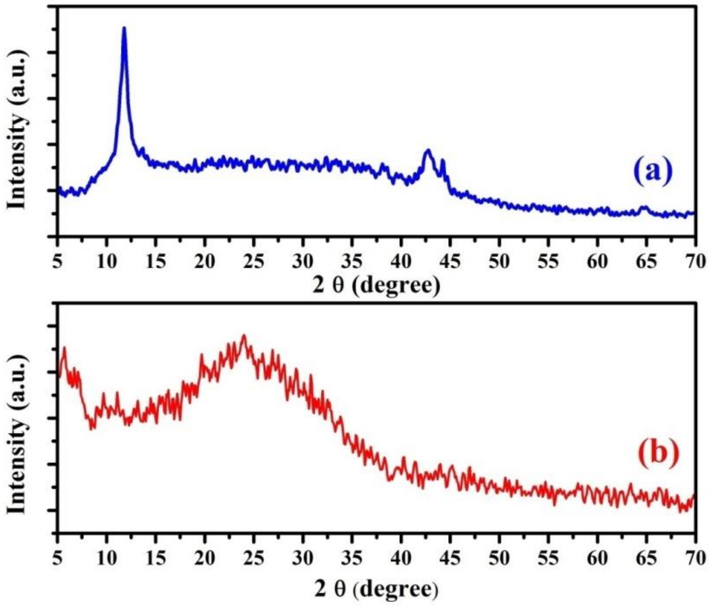

Figure 1. XRD pattern of GO/rGO nanosheets

The diffraction peaks of rGO at 10.30, 23.31& 43.76 with corresponds that (001), (002) & (100) diffraction plane of the hexagonal crystal structure with lattice constants a=2.47 and c=6.79 Å.The crystalline size (D) of the GO/rGO samples were calculate using Scherrer formula based on (1)

$$D = \frac{0.89\lambda}{\beta \cos\theta} \qquad (1)$$

where λis the wavelength of the X-ray radiation,θis the diffraction angle and βis the full width at half maximum (FWHM). Measured broadening of the GO/rGO samples with (001), (100) and 001),(002), (100) X-ray peaks gave average crystalline size about at 72.97 nm, 14.03 nmand 19.59 nm, 14.31 nm, 21.23 nm for the GO/rGO.

4. FESEM ANALYSIS

FESEM morphology of GO/rGO nanosheets are shown in Fig.2 (a-b).The morphological analysis also clearly shows the formation of GO/rGO. Both GO and rGO sheets are well micrometer size of the 2D wrinkled structure morphology [11].

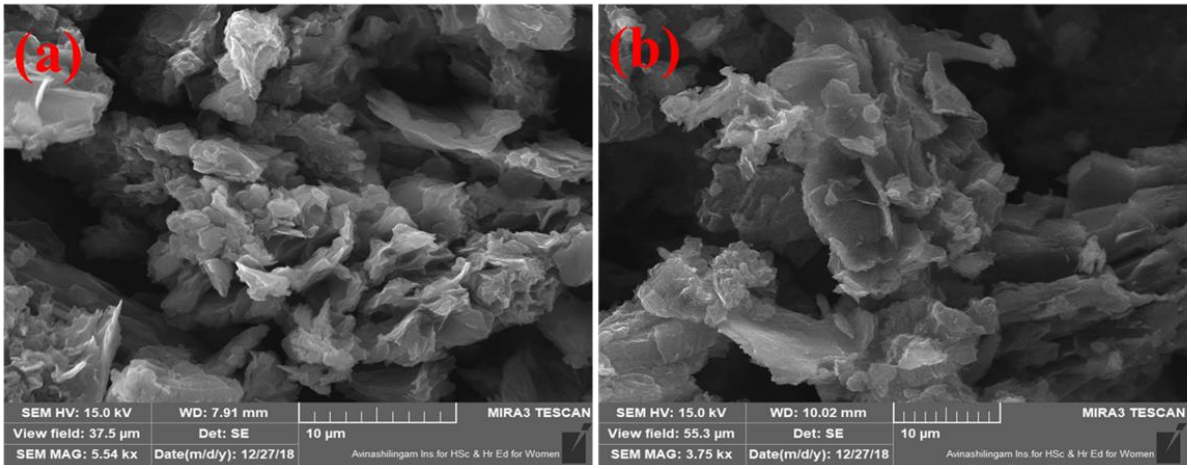

Figure 2. FESEM micrographs of GO/rGO nanosheets

5. RAMAN ANALYSIS

The structure information was studied as GO/rGO samples are exhibits that in the series of bands at 143,493,625, 687,847,1172,1369,1617,1840,1980,2234 and 2336 cm^{-1} all band can be attributed to the fundamental vibration modes in graphene oxides[12]. The reduction of GO and rGO sheets were further confirmed through Raman spectra. As shown in Fig. 3 (a,b), the Raman spectra of GO displays two characteristic Raman bands centered at 1369 at 1617 cm^{-1} are assigned to the well known D and G bands, respectively.

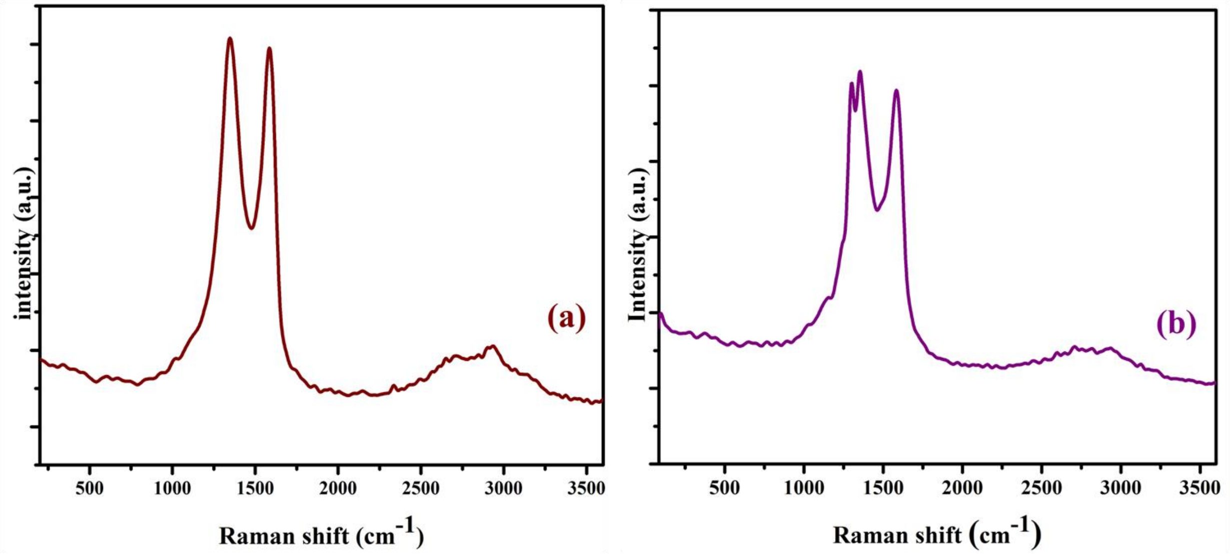

Figure 3. Raman spectrum of GO/rGO nanosheets

The D band (~1369 cm^{-1}) corresponds to the disorder in the sp^2 carbon network, and the G band(~1617 cm^{-1}) is associated with the tangential vibrations of the sp^2 carbon atoms in the hexagonal Planes[13].

In general, the D band is known as imperfect band that typically arises from the first order diffusion of sp^3 hybridized carbon atoms, while the G band is mainly reflected from the stretching vibration of sp^2 hybridized C=C bonds. From Fig. 3(a), there is a shift occurs in Raman peaks positions for pure graphene oxide. This confirms the bond formation between graphene layers. The ID/IG ratio of the D-band to the G-band is related to the disorderness of the sp^2 domainsowing to the removal of the oxygen functional groups.

6. FTIR-SPECTROSCOPY

FTIR spectroscopy analysis in order to investigate the structure and functional groups in GO/rGO. In this Fig.4 (a,b) illustration are clearly reduction of GO/rGO samples are well shows band structure confirming a successful reduction of GO. As shown as Fig.4 (a)the broad peak presented at 3420cm^{-1} in the heigh frequency area in the stretching and bending vibration OH groups of water molecules are GO adsorbed in the bonds. It can be concluded that the samplewas strong hydrophilicity. in the peak at 2364 cm^{-1} C-H asymmetric vibration which confirms the grafting of long C-C aliphatic chain reaction to the GO nanosheets[14].

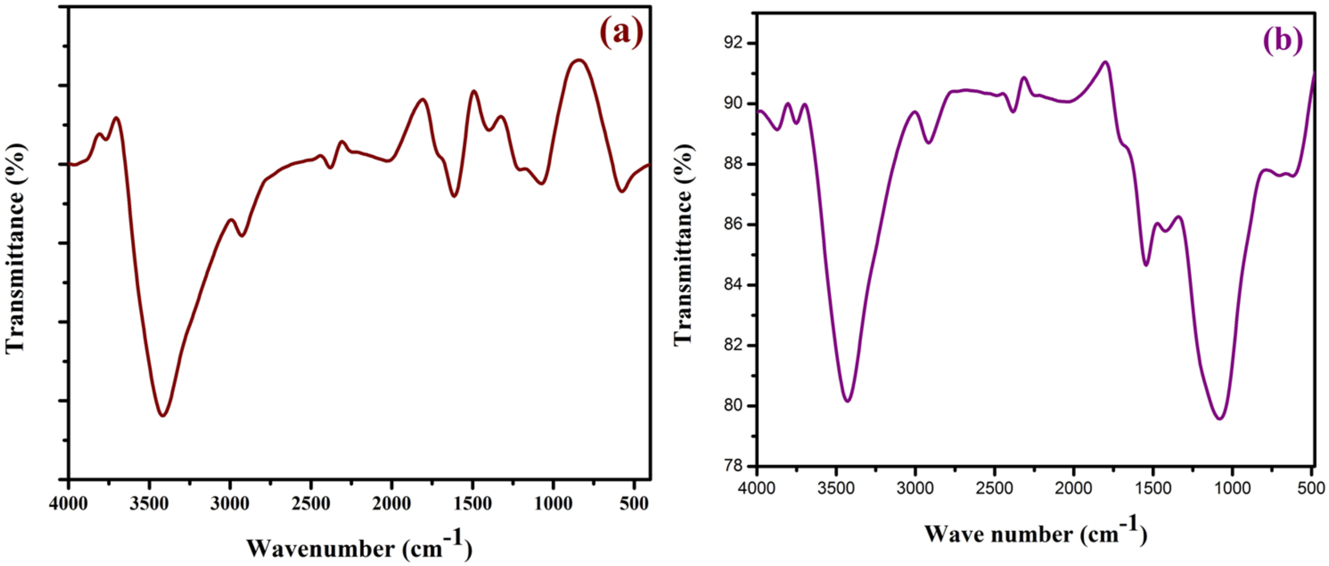

Figure 4. FTIR Spectrum of GO/rGO nanosheets

The growth of GO the eminence peaksfor carboxyl C=O were seen at 1721 cm^{-1}.in the spetracan be comaprision of the GO/rGO in Fig.4.The peak at 1616 cm^{-1} attributed to the aromatic C=C group could be seen in both GO and rGO samples. In this case of peak at 1404-1049 cm^{-1}.The peaksat 838 cm^{-1} and 588 cm^{-1} are responsible for skeletal vibration of C=C bonds and after thermal reduction peaks are sharpened as a percentage amount of C=C bonds in rGO are higher than GO.Therefore, observed that GO/rGOconfirmation of stretching vibration in the speak about at 444 cm^{-1} that most of C-O peaks containing groups onto the GO nanosheets are removed in the reduction process using rGO as the reducing agent in these peaks was observed.

7. CONCLUSIONS

The GO/rGO was successfully synthesized by Hummer's modified method and eco friendly solar induced conventional method. The XRD pattern result shows the interlayer d-spacing of rGO is to some extent higher than graphene oxide. FESEM images demonstrate wrinkled nanosheets of GO/rGO. EDS analysis shows the presence of carbon and oxygen elements in GO/rGO. The FTIR and Raman spectroscopy generalizes specific functional groups like hydroxyl, carboxyl, epoxy molecule by its sharp peaks of D and G band. This simple and cost effectivemethodeventually becomesappropriate for rGO application in nano composite materials and fabrication of various electronic devices.

8. REFERENCE

1. Novoselov KS, Geim AK, Morozov SV, Jiang D, Zhang Y, Dobonos SV, et al. Electric field effect in atomically thin carbon films. Science. 2004;306:666–9.
2. R.A. Medeiros, B.C. Lourencao, R.C. Rocha-Filho, O. Fatibello-Filho, Simultaneous voltammetric determination of synthetic colorants in food using a cathodically pretreated boron-doped diamond electrode, Talanta. 2012;97:291–297.
3. Jeong H Y, Kim J Y, Kim J W, et al. Graphene oxide thin films for flexible nonvolatile memory applications. Nano Lett. 2010; 10: 4381–4386.
4. Chen Y, Zhang X O, Zhang D C, et al. High performance supercapacitors based on reduced graphene oxide in aqueous and ionic liquid electrolytes. Carbon, 2011; 49: 573–580.
5. Cruz R, Pacheco Tanaka D A, Mendes A. Reduced graphene oxide films as transparent counter-electrodes for dye-sensitized solar cells. Sol Energy. 2012; 86: 716–724.
6. Hummers W.S., Offeman R.E. Preparation of Graphitic oxide, J. Am. Chem. Soc., 1958; 80(6): 1339-1339.

7. Aravind S.S.J., Eswaraiah V., Ramaprabhu S. Facile and simultaneous production of metal/metal oxide dispersed graphene nano composites by solar exfoliation. J. Mater. Chem., 2011; 21: 17094-17097.
8. Mohandoss M., Gupta S.S., Nelleri A., Pradeep T., maliyekkal S.M. Solar mediated reduction of graphene oxide. RSC Adv. 2017; 7:957-963.
9. Thangavel P., Kannan R., Ramachandran B, Moorthy G., Suguna L., Muthuvijayan V. Development of reduced graphene oxide (rGO)-isabgolnano composite dressings for enhanced vascularization and accelerated wound healing in normal and diabetic rats. J. Coll. Inter. Sci. 2018; 517:251-264.
10. Becerril H A, Mao J, Liu Z, et al. Evaluation of solution-processed reduced graphene oxide films as transparent conductors. ACS Nano. 2008; 2: 463–470.
11. Pham V H, Cuong T V, Hur S H, et al. Fast and simple fabrication of a large transparent chemically-converted graphene film by spraycoating. Carbon. 2010; 48: 1945–1951
12. Wang S, Ang P K, Wang Z Q, et al. High mobility, printable, and solution-processed graphene electronics. Nano Lett. 2010; 10: 92–98 .
13. Eda G, Fanchini G, Chhowalla M. Large-area ultrathin films of reduced graphene oxide as a transparent and flexible electronic material. Nat Nanotech. 2008; 3: 270–274.
14. Li X L, Zhang G Y, Bai X D, et al. Highly conducting graphene sheets and langmuir-blodgett films. Nat Nanotech. 2008; 3: 538–542.