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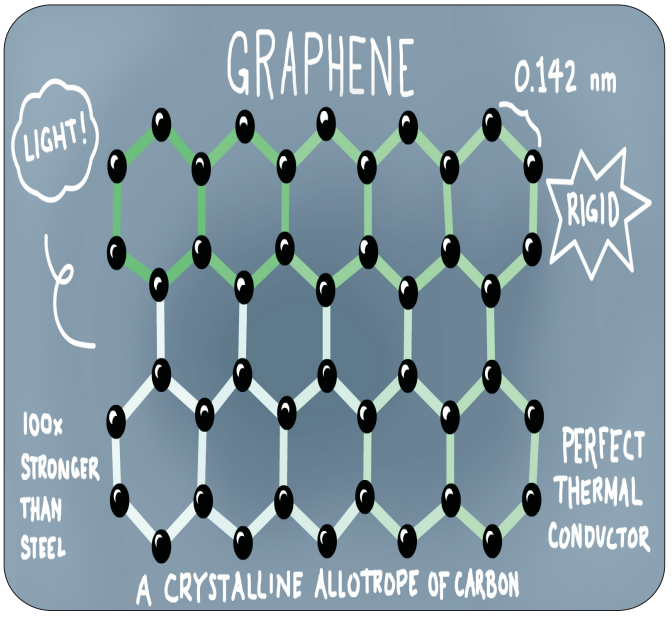
Review Of Research

SYNTHESIS OF GRAPHENE USING NMP BY ULTRASONICATION

Prerna Kaushik

Co - Author Details :

Vandana Sharma



ABSTRACT

Graphene is known as an extraordinary substance possessing unique properties. These properties make it a suitable material for making new improved optical and electronic devices. Study reveals that graphene can be synthesized adopting a number of methods. Exfoliation of graphite using ultrasonication is found to be the simplest method. In this paper graphene synthesis by employing N-methyl-Pyrroliodone solvent is discussed. Raman spectroscopy and UV visible spectroscopy has been explained. Further a comparative study has been done.

KEYWORDS :Graphene, Ultrasonication, NMP, UV-Vis, Raman.

1. INTRODUCTION

Graphite, an abundant natural mineral is the most common allotropic form of carbon .Graphite has sp^2 hybridized carbon atomic layers, stacked together by weak vander Waals forces. Graphene is single layers of carbon atoms tightly packed into a two-dimensional (2D) honeycomb crystal lattice. The name “graphene” was introduced by Boehm, Setton, and Stumpp in 1994 [1]. Graphene shows an extraordinary performance in terms of electrical conductivity. A number of techniques for preparing graphene sheets have been developed but only a few yield graphene in appreciable quantity. Chemical vapor deposition and epitaxial growth, yield graphene with some small figure of defects, promising these techniques to be highly efficient for applications in electronic devices. Larger quantities of

graphene sheets can be formed by employing physical or chemical exfoliation of graphite. The interplanar spacing of graphite is 0.34nm which is not appreciable to have room for organic molecules/ions or other inorganic species. A number of intercalation strategies can be applied to extend the interlayer galleries of graphite from 0.34nm to higher values, which can attain more than 1nm. Graphite intercalation compounds (GICs) are stabilized between the graphene layers through ionic or polar interactions with no alteration of graphene structure. GICs can be formed not only with lithium, potassium, sodium but also with anions like nitrate, bisulfate, or halogens. Graphene find its application in fabrication of many power electronics devices such as supercapacitors.

2. MATERIALS AND METHODS

2.1 MATERIALS USED

Graphite fine powder (Extra pure) and N-Methyl 2-pyrrolidinone(NMP with CAS:872-50-4) were used without any dilution or distillation.

2.2 SUSPENSION SYNTHESIS

A stable, homogenous dispersion of Graphene can be obtained by employing a simple chemical approach. In a typical process, Graphite (0.1 gm) was mixed with NMP (100ml) in a glass beaker. The mixture was sonicated in an ultrasonicated bath for 12 hours at 50-60°C. After that the sample in dispersion form was transferred in vials. The dispersion was centrifuged at 7000 rpm for 15 minutes. Then this centrifuged dispersion was heated to reduce it to 50% so as to make it more viscous for coating purpose. On a cleaned glasss slide, NMP dispersed solution was coated using spin coater. Approximately 7-8 coatings were done using spin coater so as to get uniform layer on substrates. Finally the prepared samples were sent for Raman Spectroscopy and UV-Vis characterization.

3. RESULTS AND DISSCUSSION

3.1 UV-VIS

This method is adopted for measuring absorption or transmission in transparent or opaque solids and liquids. A beam of light is passed through specimen and the remaining light gets monitored in a detector. The range of wavelength to be used for analysis is 200-800 nm. As the light falls on the sample, the sample will absorb the light being passed. This is because of those few molecules which are present on the sample, which absorbs the light depending upon their structure and chemical bonding providing peaks at different wavelengths in this range. The figure shows the peaks obtained from NMP suspension.

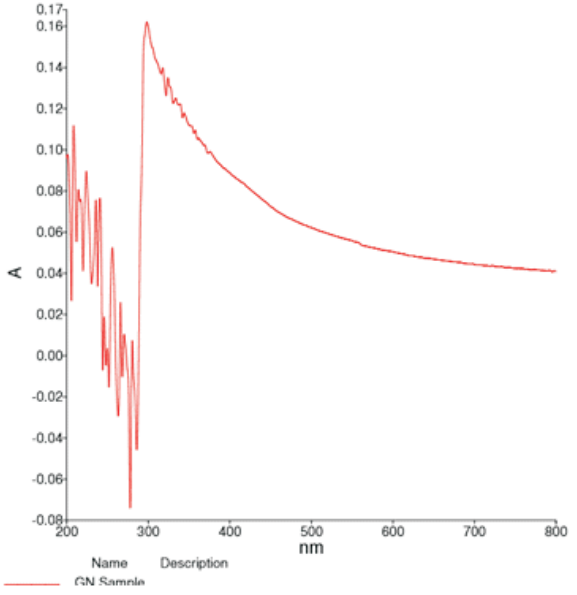


Figure 1 UV-VIS Results of Graphene Synthesized Via NMP

The GO and graphene formation with sonication method can also be explained by referring UV-vis spectroscopy studies for the optical absorbance range from 200 nm to 800 nm .The fig shows the absorption peak around 300 nm and with further increase in wavelength the absorption decreases this confirms the exfoliation of graphite in NMP too as reported[6].

3.2 RAMAN SPECTROSCOPY RESULTS

Raman Spectroscopy reveals about the structural properties of graphene. It basically tells about the formation of defect free graphene. It is responsive towards the number of graphene layers as well as the doping defects. The intensity of D band and G band peaks obtained at around 1350/cm and 1580/cm are noted and their ratio must be calculated in order to confirm the doping free formation of graphene.

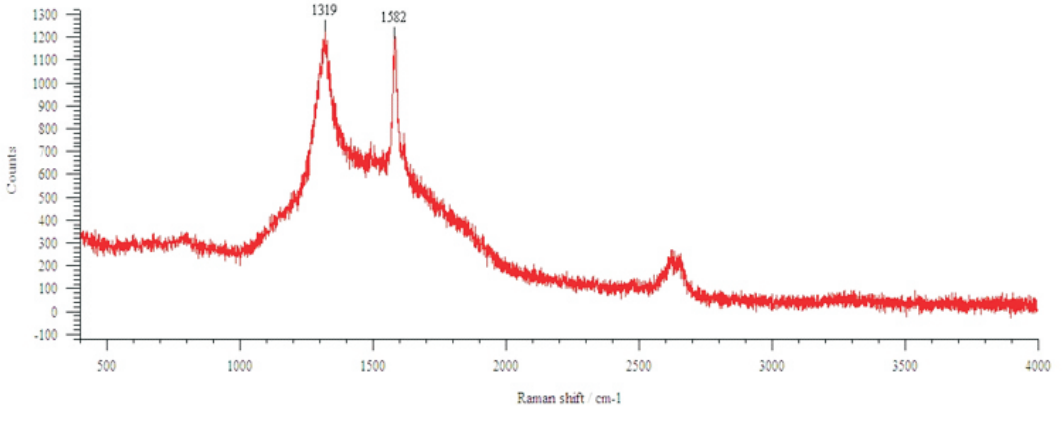


Figure 2 Raman Spectroscopy Results of Graphene Synthesized Via NMP

Moreover, one can calculate the I_D and I_G and therefore the ratio ID/IG can be calculated by using the corresponding intensities of the peaks at 1319/cm and 1582/cm. The ratio I_D/I_G is found to be 1.031.Earlier results reported in previous associated work suggests that the G band at 1577.3/cm and D band at 1356.2/cm in case of original graphite with ratio 0.036 and D band decreased at 1343.8/cm and G band increased a 1584/cm with ratio 1.96 in case of exfoliated graphite exists. Also it is mentioned that I_D/I_G ratio of 0.86 has been reported in case of graphene nanosheets. The G band reveals the stretching of sp^2 atoms and the D band reveals free state or breathing state of sp2 atoms. The sharp G band peak depicts the electrochemical mixing of impurities or defects.

4. CONCLUSION

Study of graphene demonstrating the Raman spectroscopy and UV-Vis results are reported. Raman spectroscopy is found to be very helpful and effective tool in detection of graphene layers and analyzing their properties.

REFERENCES

[1] Boehm, H.P., Setton, R., and Stumpp, E. (1994) Pure Appl. Chem., 66, 1893.

[2] Karthikeyan Krishnamoorthya, Murugan Veerapandianb, Gui-Shik Kima and Sang Jae Kima, 2012,"A One Step Hydrothermal Approach for the Improved Synthesis of Graphene Nanosheets", Current Nanoscience, Vol. 8, No. 6

[3] Muhammad Mohsin Hossain, Jae Ryang Hahn, and Bon-Cheol Ku,2014, "Synthesis of Highly Dispersed and Conductive Graphene Sheets by Exfoliation of Preheated Graphite in a Sealed Bath and its Applications to Polyimide Nanocomposites", Bull. Korean Chem. Soc., Vol. 35, No. 7

[4] Sumanta Sahoo, Goutam Hatui, Pallab Bhattacharya, Saptarshi Dhibar, Chapal Kumar Das, 2013, "One Pot Synthesis of Graphene by Exfoliation of Graphite in ODCB" Scientific Research Graphene, 2,42-48.

[5] Yang H, Hernandez Y, Schlierf A, Feltren ,2013 ,"A simple method of Graphene production based on exfoliation of graphite in water using 1-pyrenesulphuric acid sodium salt", Carbon 53357-365,Elsevier B.V.

[6] Masoomeh Asadi, Fatemeh Zahraei, kourosh rahimi, Mahdi ghazanfari, Ahmad Yazdani and Reza Poursalehi. 2014,"Synthesis and characterization of Graphene in High Yield with Exfoliation of Graphite in Organic Solvent", Opsi IRDT.

[7] Subrahmanyam S.K, Vivekchand S.R.C, Govindaraj A,and Rao. C.N.R 2008, "A study of Graphenes prepared by different methods: characterization, properties and solubilization", Journal of Material Chemistry,18, 1517-1523/1517.

[8] D. Li, M. B. Mueller, S. Gilje, R. B. Kaner and G. G. Wallace, "Processable Aqueous Dispersions of Graphene Nanosheets," Nature Nanotechnology, Vol. 3, No. 2, 2008, pp. 101-105. doi:10.1038/nnano.2007.451

[9] L.-Y. Meng and S.-J. Park,"Synthesis of Graphene Nano- sheets via Thermal Exfoliation of Pretreated Graphite at Low Temperature," Advanced Materials Research, Vol. 123-125, 2010, pp. 787-790. doi:10.4028/www.scientific.net/AMR.123-125.787

[10] W. Yang, E. Widenkvist, U. Jansson and H. Grennberg, "Stirring-Induced Aggregation of Graphene in Suspension," New Journal of Chemistry, Vol. 35, No. 4, 2011, pp. 780-783. doi:10.1039/c0nj00968

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