

A comparative study of graphite nanosheets: synthesized vs commercial

L.S. Montagna^{1,*,#}, T.L.A. Montanheiro¹, J. P. B. Machado², A.P. Lemes¹, M.C. Rezende¹

¹Federal University of São Paulo (UNIFESP), Institute of Science and Technology, Technology Laboratory of Polymers and Biopolymers, São José dos Campos, SP, Brazil.

²National Institute for Space Research (INPE), Associated Laboratory of Sensors and Materials (LAS), São José dos Campos/SP, Brazil.

#Corresponding author: larissambiental@yahoo.com.br

Graphite is an allotropic form of carbon found naturally in igneous, sedimentary or metamorphic rocks in flakes form. Furthermore, has excellent physical, chemical, electrical and magnetic properties, with an ability to make composites and nanocomposites with various organic and inorganics functionalities. Graphite is formed by several graphene sheets of a few nanometer thick and hundreds to thousands nanometers long connected by van der Waals forces [1]. One method for isolate graphene sheets from natural graphite is by means of chemical, thermal and physical treatments. Thus, it is possible to obtain graphite nanosheets (GNS) [2]. Several methods for obtaining graphite nanosheets have been studied by several research groups in recent years. This work aims to study the difference of graphite nanosheets synthesized (GNS/S) in laboratory and commercial graphite (GNS/C), by X-ray diffraction (XRD), Raman spectroscopy and Field Emission Gun-scanning Electron Microscopy (FEG-SEM). FEG-SEM micrographs show the treatments (chemical, physical and thermal) did not damage the structure of graphene sheets and supported their isolation. Raman and XRD spectra's demonstrate the formation of graphite nanosheets with nanometric dimensions, results which resemble the properties presented by commercial graphite. XRD of GNS/S indicates a lower crystallographic ordering of these when compared to GNS/C. This behavior is the result of higher crystallinity defects, which can be caused by the distortion of the orientation of the graphene sheets and also by a decrease in the number of graphene sheets stacked in each crystal. Raman spectra of GNS/S and GNS/C show the presence of the D-band, but with higher intensity for GNS/S, which may be associated with the disorder of the sp^2 carbon. The reduction of sp^2 plane size is explained by defects in the structure, vacancies and distortions of the sp^2 domains and oxygenation of the graphite, i.e. defects associated with carbon disorder.

[1] K. Krishnamoorthy, G-S. Kim and S. J. Kim, *Ultrason Sonochem*, **20**, (2013) 644.

[2] L. S. Montagna, F. C. Fim, G. B. Galland and N. R. S. Basso, *Macromol. Symp.*, **48**, (2011) 299/200.