

GRAPHENE STRUCTURES OBTAINED FROM BIOMASS

P. Ciepielewski*, M. Dudynski**, G. Kowalski[^], M. Tokarczyk[^], I. Jozwik*, P. Gebarowski ^{^^}

*Institute of Electronic Materials Technology, Warsaw, Poland

**MTF and Institute for Theoretical Physics, Warsaw University, Warsaw, Poland

[^]Faculty of Physics, University of Warsaw, Warsaw, Poland

^{^^}Institute of Ceramics and Building Materials, Warsaw, Poland

Pawel.Ciepielewski@itme.edu.pl

The possibility of obtaining graphene flakes directly from the charcoal (wood) is presented. The Raman and XRD (X-ray diffraction) experimental data for the charcoal and activated charcoal (birch-wood) have been analyzed before and after high Ar pressure (150 and 300 MPa) and high temperature (1700C and 2000C) sintering. Before thermal and pressure treatment the Raman spectra were similar to that usually observed in GO (graphene oxide) [1]. After the treatment, the Raman data revealed, for both materials, existence of characteristic for graphene sharp G, D, D' and 2D modes. The energies and widths (FWHM) of these modes and their relative intensities indicated the existence of monolayers and multilayers graphene structures with estimated flakes sizes ranging from 15nm to 150 nm (according to I(G)/I(D) relation proposed in [2]). The example of the Raman spectrum and the spatial map of one of the flakes (removed from the sintered charcoal in ultrasonic washer), corresponding to graphene monolayer, is presented in Fig1. Neither characteristic features of graphitic structure as observed in [3] nor 3D carbon structures (fullerenes, nanotubes) have been found in the Raman spectra. The XRD data before sintering shows some features characteristic for amorphous carbon. After sintering XRD data revealed the existence of few-layer graphene structures along thick, turbostratic stocked graphene layers.

The experimental results gives an insight in the process of carbonization of biomass and allowed the verification of many theoretical models concerning the mechanisms of creation of the carbon nanostructures and their properties.

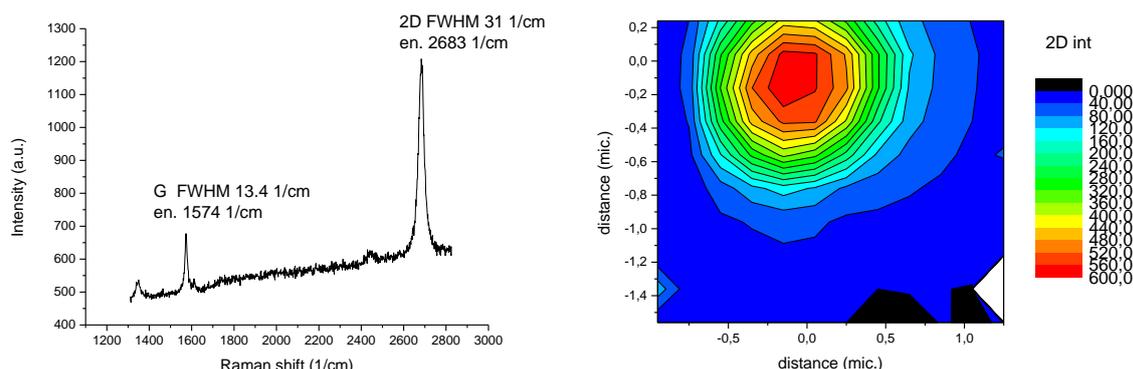


Fig.1. Raman spectrum of graphene flake (left), 2D Raman mode intensity map (right).

[1]. Adarsh Kaniyoor and Sundara Ramaprabhu, AIP Advances 2, 032183 (2012).

[2]. L.G. Cancado et al. (2008) Appl. Phys. Lett., (2006), 88, 163106.

[3]. Jinggeng Zhao et al. Carbon 47 (2009) 744-751

