UV optical absorption studies of surface plasmon resonance in water suspension of multi-shell nanographites

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UV optical absorption spectroscopy is a powerful tool for testing the optical extinction properties of nanocarbons with an extended π-electron system.

Nanographite (NG) particles were produced by annealing of detonation nanodiamonds (grain size ~5 nm) during various exposure times, as described in [1]. A series of various NG suspensions were prepared by repeated controlled dilution of initial dense suspension with weight concentration (~0.1 mg/ml).

The aim of this research was to find the correlation between the UV optical absorption of NG suspensions and structure of NG particle. The Raman spectra of the NG samples excited at 514 nm were analyzed. The Tuinstra- Köning approach applied for evaluation of the NG crystallite in-plane sizes by using of the D- and G- band (~1340 cm^{-1} and 1580 cm^{-1}) heights ratio gave results (~3.5 nm) coinciding well with those one obtained from X-ray diffraction data.

The broad absorption peaks around 255-265 nm related with surface plasmon resonance (SPR) were found in optical extinction spectra of all NG suspensions. Following to Pascoli and Leclercq [2] the increase in number of carbon atoms in planar graphitic sheet from 150 to 486 as well as the reduction of number of randomly distributed sp^3-hybridezed atoms in a graphitic cluster leads to the smoothing of absorption hump at ~220 nm. The same trend is also observed in our case where the suspension of NG with minimal content of amorphous phase and a little bit higher crystalline perfection demonstrates less featured absorption hump at 265 nm in comparison with that one for the suspension of more defective NG. The research on the influence the amount of defect sites and imperfections of NG particles together with its aggregation state in water suspension on the shape and intensity of SPR peak is in progress now and will be reported elsewhere.

[1] V.Yu. Osipov, T. Enoki, K. Takai et al. *Carbon* **44**, 1225 (2006).
[2] G. Pascoli, J. Leclercq, *Astrophysics and Space Science* **235**, 233 (1996).