Properties of onion-like carbon produced from nanodiamond

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An overview of the detonation nanodiamond graphitization leading to the formation of onion-like carbon (OLC) is presented. Diamond graphitization is considered as multi-step process consists of the decomposition of surface groups stabilizing diamond structure, reconstruction of bare diamond surface, formation of primary graphitic species and with their further transformation into carbon nanostructures.

Variation of annealing parameters allows producing sp^2/sp^3 nanocomposites, onion like carbon and polyhedral closed nanographitic particles. The knowledge of the kinetics of ND graphitization provides ones with the possibility to produce the diamond/nanographite composites with variable ratio of decreasing in size diamond core and defective curved graphitic shells (sp^2/sp^3 nanocomposites). Special attention was devoted to the influence of the ND aggregation ability on the aggregate size of forming OLC. Influence of gas transport reactions on OLC formation is also discussed.

Small size of curved graphitic shells, the presence of interface between nanosize diamond cores and graphitic shells and probably high concentration of open graphitic edges can cause the unusual electronic properties of these composites and OLC. All these materials are under intensive studies. They were characterized with HRTEM, Raman spectroscopy, XRD, XPS, EELS, ESR, X-ray emission spectroscopy and the electrical resistivity measurements. Current and potential applications of nanostructures produced via diamond annealing are briefly analyzed with a special accent on the possibility to use ND and OLC in coatings and formulations effectively attenuating EM radiation.