Tunable Electromagnetic Response in Onion-like Carbon Based Materials

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Nanocarbons are perspective for the design of electromagnetic wave absorbing and shielding materials. The first results of the microwave characterization in S-, X- and Ka-bands of onion like carbon powders (OLC) and OLC-polymer films presented in [1-4] demonstrate high attenuation of the given samples over the wide MW frequency range. Here we present the results on the electromagnetic response of OLC of variable composition in Ka-band range (26-37 GHz) combined with measurements of temperature dependence of conductivity.

Controllable explosive nanodiamond (ND, d~4-5 nm) graphitization at 1200-1900K allows 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) and finally onion like carbon. The observed one dimensional variable range hopping conductivity (4-300K) combined with HR TEM data was attributed to the formation of continues ribbon-like defective graphene scales. The increase of ND annealing temperature results in the increase of density states of conductive electrons and corresponding increase of conductivity of OLC produced. It was found that conductivity data correlates with EMI response of OLC in 26-37.5 GHz range. So the increase of conductivity of OLC results in the increase of EM wave attenuation ability because of growing reflectance ability. So the variation of the composition of OLC allows producing materials with controllable EM response.

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