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Low-Temperature Reduction of Graphene Oxide: Electrical, Raman and Kelvin Probe Research

Reduced graphene oxide (GO) is very promising 2D material for fabrication of high conductive transparent thin films and chemical sensors. However up to now reducing of this material was performed in vacuum or in some special atmosphere at high temperature. In this work we study the electrical and structural properties of GO films after their thermal reduction at temperature not more than 250°C at room atmosphere. The GO was synthesized by Hummers' method and transformed into water solution. The GO films were obtained by drying of the deposited solution on glass wafer. Deposited and annealed samples were measured by 4 probe method, micro-Raman spectroscopy, FTIR spectroscopy, AFM and KPSM. It was shown that in temperature range from 100 to 220°C a resistance of the GO films strongly decreased from 4x1011 to 3x106 Ohm sq. During such strong transformation of the electrical conductivity we detected extraction of water molecules and OH bonds from the material and formation C=O and C-O-C bonds. The mRS demonstrates formation of D* phonon line at 1120 cm-1 which is associated with sp3 rich phase of disordered amorphous carbons. Study by AFM and KPSM combined with heating control system shows strong changing surface potential inside of the GO flakes during annealing from 100 to 220°C, that can be associated with desorption of water molecules and OH groups, and small changing of the flakes thickness. Important thing is the absence of surface potential changing on edges of the GO flakes. The origin of observed phenomena is discussed.

Biography

Alexei Nazarov has completed his habilitation on DrSci in Physics and Mathematics at the age of 42 years from Institute of Semiconductor Physics NASU. He is the head of department of Functional Materials and Nanostructure. He has published more than 250 papers in reputed journals and has been serving as special editor and author of 11 books and journals.

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