

# Physical and chemical characteristics of partially reduced graphene oxide

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There have been measured physical and chemical characteristics of graphene oxide (GO) samples annealed at temperatures from 100 up to 800°C. The samples were produced by the use of the standard Hummers method. The degree of graphene oxide reduction was determined as a result of measurements of the conductivity of GO samples at various temperatures. The measurements imply that samples become conductors within the range of the annealing temperature between 100 and 200 °C when the conductivity of the material increases by five orders of magnitude. The quantity of oxygen removed from the samples was determined on the basis of measurements of the density of samples annealed at various temperatures and through the XPS measurements. The measurements indicate that practically full removal of oxygen occurs at a temperature of 800 °C. The density data consist with XPS measurement data presuming that the main species evolving at annealing is carbon monoxide (CO). The analysis of Raman spectra of samples implies rather high degree of structural disordering of GO samples for all the annealing temperatures. The measurements of the current-voltage characteristics of GO samples annealed at various temperatures demonstrate non Ohmic character of the conduction of those which manifests itself in decreasing the resistivity as the applied voltage increases. The sensitivity of the resistivity of samples to the magnitude of the applied voltage

increases monotonically the annealing temperature. Such a behavior is described qualitatively within the frame of the percolation conduction model, in accordance with which the charge transport proceeds along conducting paths formed contacting GO fragments. The dependence of the contact resistance on the applied voltage determines non Ohmic conduction of GO samples.