ELECTROCHEMICAL CHARGING OF FUNCTIONALIZED SINGLE-WALLED CARBON NANOTUBES

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Abstract

Non-covalent and covalent functionalization of carbon nanotubes (CNTs) by different functional groups (e.g. aryl sulfonic, carboxylic, amide) can enhance the solubility, conductivity and electrical properties of CNTs for further application in gas-detecting sensors. The single wall carbon nanotubes (SWCNTs) were functionalized by aryl sulfonic (SO3H) functional group and were dispersed in water, the dispersion remained stable for several months. The degree of embedded functional groups was estimated by thermogravimetric analysis (TGA). The electronic structure of SWCNT/SO3H composite was studied by in-situ Raman spectroelectrochemistry and it was dependent on a doping level caused by applied electrochemical potential. By applying a positive electrochemical potential the SWCNTs/SO3H were p-doped and there were clear upshifts of 2D Raman modes. On the other hand for the n-doped samples, caused by applying of negative potential, the G Raman mode was reduced. The Radial Breathing Mode (RBM) region displayed changes during electrochemical charging. The observed changes in the Raman spectra suggest a covalent bonding of functional groups to carbon nanotube. Such doped SWCNTs/SO3H with improved conductivity could be exploited as transparent conductive films in gas-detecting sensors.

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