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Structural studies of multiwall carbon nanotubes suspensions in presence of selected monomeric and dimeric surfactants and comparison to suspensions stabilized by pluronics

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Carbon nanotubes (CNT) are tubular nanostructures, characterized by unique physical and chemical properties. However, because of the hydrophobic nature of CNTs surface and very strong interactions between these nanoparticles, it is a question how to prepare the homogenous suspension of CNTs in water and then effectively separate CNTs aggregates into individual tubes while maintaining their properties. Recently, there are two approaches to solve this problem: the chemical functionalization of the nanotubes surface (which can strongly affect the electronic structure of the tube) and the non-covalent modification by using dispersive agents. It has been shown that the non-covalent modification using amphiphilic molecules of the CNTs surface effectively leads to the formation of stable suspensions of carbon nanotubes in water[1].

Nowadays, one of the most frequently used dispersing agents are block copolymers named Pluronics (poly(ethylene oxide)-poly(propylene oxide)-poly-(ethylene oxide) [PEO-PPO-PEO]) [2], that are biocompatible, nontoxic and commercially available. However researches are looking for alternative, more efficient systems for dispersing nanotubes in aqueous solutions. In present studies monomeric and dimeric surfactants with imidazolium group are used. Preliminary study indicate that suspension of MWCNT with dimeric imidazolium surfactants are stable for more than 3 months (Figure 1).

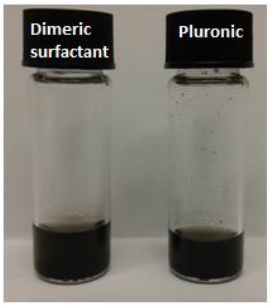

Figure 1. Suspensions of MWCNT with dimeric imidazolium surfactant as a dispersing agent (left) and with pluronic P123 (right).

The influence of PEO-PPO-PEO and bis-imidazolium surfactants on the MWCNTs structure in aqueous suspensions and the water dynamics had been studied. The morphology was investigated by means of Transmission Electron Microscopy (TEM) and the water dynamics in MWCNTs suspensions was analyzed using Nuclear Magnetic Relaxation Dispersion (NMRD) method. The NMRD profiles provide information about slow molecular motions that affect the spin-lattice relaxation and allow to understand more the nature of processes taking place at the water-MWCNTs interface [3]. In addition spectroscopic (FTIR/Raman) methods were used. The results from all these studies can be used to assess the dispersion of MWCNTs in water, thus the quality of the aqueous MWCNTs suspensions.

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