Synthesis of electrically conductive nanobrush and its characterization

We are interested in synthesizing an electrically conductive nano material that can be blended into a non-conductive polymeric host matrix to act as an electromechanical sensor under mechanical stress. An electrical sensor network responding to molecular scale deformation would be useful for advancing knowledge about the mechanisms for material breakdown. In order to preserve the mechanical properties of the host matrix, the sensor network should be a very minor component (at about 0.2%) of the composite material [1]. This requirement demands the use of nano conductive fibers that can form connective networks with a low percolation threshold.

This seminar mainly focuses on the synthesis and characterization of electrically conductive nano material, so called "conductive nanobrush" (CNB). We have taken new route for this synthesis by avoiding the traditional methods of covalently modifying the surface of carbon nanotubes (CNT). CNB has flexible hairs as a brush, densely sheathed on the surface of CNT. The structure of the brush is proved by TEM and AFM images.

The polymeric brush is solvated into solvent rather than aggregated particles of polymeric fiber [2], which makes it suitable to blend with host polymer matrix. Additionally, CNB has shown wide spectrum of applicability in the field such as thermoelectric material for harvesting solar energy and compatible with collagen gelation.

1. Heeder, N.J., et al., *Electrical Response of Carbon Nanotube Reinforced Nanocomposites Under Static and Dynamic Loading.* Experimental Mechanics, 2011.
2. Salvatierra, R.V., M.M. Oliveira, and A.J.G. Zarbin, *One-Pot Synthesis and Processing of Transparent, Conducting, and Freestanding Carbon Nanotubes/Polyaniline Composite Films.* Chemistry of Materials, 2010. **22**(18): p. 5222-5234.