Multiwall Carbon Nanotube Forest: Synthesis, Structure and Applications

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Arrays of the oriented perpendicular to the surface of carbon nanotubes (CNTs) exhibit anisotropy of mechanical, electrical and optical properties that allows producing new types of functional materials and devices. In last years, new technological approaches based on CVD methods were developed for the synthesis of films from multiwall and single-wall CNTs. Significant changes in the structure of the nanotubes, the distribution density on the surface can be achieved by varying parameters of the synthesis. Changing of the chemical structure of the starting hydrocarbon compounds and varying the synthesis temperature provides a CNT arrays with different texture, electrical and magnetic properties. The developed CVD reactors allow growing the arrays with high about 5 mm and square of 500 cm^2 on silicon, quartz or copper substrates.

For last few years increase interest to black –body materials from CNT arrays. We demonstrate how synthesis conditions and post synthesis treatment can regulate absorbtion properties of carbon nanotube surface. The combination of anisotropic carbon nanotube (CNT) arrays with semiconducting nanoparticles (NP) makes it possible to create a new class of low-dimensional hybrid materials with unique electronic, optical and chemical properties. Luminescent properties of the nanoparticles deposited on CNT tips were studied with applying the voltage to the silicon substrate or irradiating the CdS/CNT hybrid by ultraviolet light. It is found that electroluminescence has the green color characteristic for bulk CdS, while photoluminescence corresponds to the blue spectrum of quantum dots with an average size of ~1.53 nm. From high-resolution transmission electron microscopy examination, the observed spectral difference is attributed to different size of CdS nanocrystals grown on the surface and in the interior of the array.

In this work we present synthesis of different kinds of semiconductor NP like molybdenum sulfide MoS_2, cadmium sulfide CdS and diamonds on CNT surface and tips.