Carbon Nanotube Separation by Electronic Types using Single Surfactant based Density Induced Separation Method

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Single-walled carbon nanotubes (SWNTs) are one of the candidate materials for future nano-electronics due to their outstanding electrical, optical and thermal properties. However, current methods synthesizing SWNTs result in production of mixtures of nanotubes with different electrical properties, which are determined by the physical structure of the nanotubes. The heterogeneity prevents their potential application such as flat panel display, solar cell, etc. Here we demonstrate the methods of sorting metallic or semiconducting SWNTs using density gradient ultracentrifugation. Separation using density difference is facilitated by using only single surfactant, i.e., sodium dodecyl sulfate (SDS), which is strongly adsorbed on the metallic over semiconducting nanotube surface by mirror charge. We show that heterogeneous samples of SWNTs grown by the HiPco and arc discharge method are readily sorted. Films made of unsorted HiPco SWNTs shows a sheet resistance of ~ 1117Ω/sq at 76.8% transmittance, while films made of separated metallic HiPco SWNTs shows a sheet resistance of ~306.5Ω/sq for a film of metallic HiPco SWNTs of the same transmittance.