MECHANISM BEHIND SEPARATION OF SINGLE-WALLED CARBON NANOTUBE VIA DENSITY GRADIENT ULTRACENTRIFUGATION USING CO-SURFACTANT DISPERSIONS

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As one of the most promising and effective techniques to separate single-walled carbon nanotubes (SWNTs), the density gradient ultracentrifugation (DGU) method is widely used to obtain SWNTs with desired chiralities, diameters, or electronic types. We present a tuning technique of this surfactant-assisted technique of SWNTs from diameter-dependent separation to electronic-type separation, by adjusting co-surfactant dispersing conditions of SWNTs. The resulting buoyant densities, layer positions, and optical absorbance information of successive separated layers are analyzed and they suggest that when bile salts such as sodium deoxycholate (DOC) and anionic salts like sodium dodecyl sulfate (SDS) are involved in the DGU process, their hydration conditions, affinities with SWNTs, and surrounding environments (relative ratio of these surfactants) will determine the exchange process of different surfactants. This will furthermore determine the adsorption morphologies and the buoyancies of resulting surfactant-SWNT micelles. A model described here explains these experimental results and it can help design new DGU experiments by predicting outcomes of different starting recipes.