

474b Separation of Functionalized Single-Walled Carbon Nanotubes Via Gel Electrophoresis

Monica Usrey, Ethan S Lippmann, and Michael S. Strano

Since their discovery in 1993, single-walled carbon nanotubes (SWNTs) have attracted a great deal of attention due to their extraordinary optical, electrical, and physical properties. The covalent functionalization of nanotubes via various chemical pathways is used to increase SWNT solubility in organic solvent or aqueous solution, to attach functional groups for sensing or other applications, and to modify the electronic or optical properties. One example, the functionalization of SWNT with diazonium salts, offers an electronic structure selective pathway where metallic nanotubes react selectively over semiconducting nanotubes under controlled conditions. In cases such as these, it is desirable to separate the functionalized species from the unfunctionalized species. The separation of single-walled carbon nanotubes by length has been demonstrated using gel electrophoresis with an anionic surfactant in TAE buffer. In this system, the negatively charged surfactant caused the SWNT to migrate toward the (+) electrode based only upon the mass (length). Adapting this technique using a neutral surfactant allows the mobility of the SWNT to be based on the charge per unit length of the nanotube. Functionalizing the nanotube with moieties that can be deprotonated and running in a high pH buffer causes the SWNT to migrate based on the number of charged groups present (extent). In this work, we investigate the modulation of nanotube electrophoretic mobility using functionalization with 4-hydroxybenzene diazonium and the use of gel electrophoresis in the separation of functionalized SWNT from non-functionalized SWNT modified with this reagent.