Novel SWCNT-based Immunoprobes for Spectrally Multiplexed Detection and Imaging in Biomedical Applications

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It is well known that each structural species of semiconducting single-walled carbon nanotube (SWCNT) shows a sharp emission peak in the short-wave infrared (SWIR) at a wavelength characteristic of its structure. Recent advances in SWCNT sorting now provide a variety of nanotube samples with distinct emission signatures. We are linking these sorted SWCNTs to antibodies to make novel SWIR fluorescent immunoprobes that can complement conventional immunoprobes in biomedical applications. The new probes have several advantages. They emit in a spectral range that has negligible autofluorescent background interference and is complementary to the range of conventional fluors. The SWCNTs are also very robust fluorophores with high resistance to photobleaching. Finally, their emission spectra are narrower than those of visible fluors. These properties will allow improved spectral multiplexing, in which probes emitting at different wavelengths reveal different biological targets in flow cytometry and fluorescence microscopy. To retain SWCNT emission in the probes, noncovalent functionalization to the nanotube surface is required. We will describe results on several such linkage methods. Test results will also be presented for detection of the novel immunoprobes in a modified flow cytometer and imaging of the probes with a customized SWIR fluorescence microscope.