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Stable Sequestration of Single-Walled Carbon Nanotubes in Self-Assembled Aqueous Nanopores

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ABSTRACT

We demonstrate the ability to stably sequester individual single-walled carbon nanotubes (SWNTs) within self-contained nanometer-scale aqueous volumes arrayed in an organic continuum. Large areal densities of 4×10^9 cm^{-2} are readily achieved. SWNTs are incorporated into a surfactant mesophase which forms 2.3 nm diameter water channels by lyotropic self-assembly. Near-infrared fluorescence spectroscopy demonstrates that the SWNTs exist as well dispersed tubes that are stable over several months and through multiple cycles of heating and cooling. Absence of physical distortion of the mesophase suggests that the SWNTs are stabilized by adsorbed surfactants that do not extend considerably from the surface. Our findings have important implications for templated assembly of carbon nanotubes using soft mesophases and the development of functional nanocomposites.