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Directed self assembly of macroscopic nanowires from single-wall carbon nanotubes suspended in aqueous bile-salt solutions E. K. HOBBIE, J. A. FAGAN, M. L. BECKER, S. D. HUDSON, J. CHUN, B. J. BAUER, NIST, M. PASQUALI, Rice — Length purified and chirality enriched single-wall carbon nanotubes (SWNTs) suspended in aqueous bile-salt solutions are found to spontaneously self assemble into macroscopically long straight nanowires, both in confined geometries and on patterned substrates. By patterning surfaces with ordered arrays of hydrophobic and hydrophilic regions, we tailor the self assembly of the nanowires for potential applications in the rapid and cheap fabrication of transparent films with strong directional conductivity. We report a phase diagram in the plane of SWNT concentration and bile-salt concentration that delineates regions of stable nanotube dispersion, bulk and surface phase separation, and nanowire self assembly. The predominant mechanisms for this phase behavior are identified as hydrogen-bonding interactions between contacted bile-salt micelles, which lead to the natural formation of macroscopic fibrils, and entropic depletion interactions mediated by free surfactant micelles.

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