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**Single-walled carbon nanotubes in strong acids: controlling solubility and the liquid crystal phase.**

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Single Walled Nanotubes (SWNTs have remarkable electrical, thermal, and mechanical properties. Neat, well-aligned SWNT fibers and sheets could be the ultimate building blocks of strong, ultra-light multifunctional materials for aerospace applications, and could yield electromechanical actuators and sensors with unprecedented performance. After the achievement of scalable production of SWNTs, the difficulty of processing pristine SWNTs by liquid-phase methods has been the single most important roadblock to manufacturing macroscopic materials composed solely of SWNTs. Here we show that SWNTs dissolve at high concentration in acids; the SWNTs are stabilized because acids protonate their sidewalls, balancing wall-wall van der Waals forces. Acid strength controls the phase behaviour. At low concentration, SWNTs in acids dissolve as individual tubes which behave as Brownian rods. At higher concentration, SWNTs form a highly unusual nematic liquid phase consisting of spaghetti-like self assembled supermolecular strands of mobile, solvated tubes in equilibrium with a dilute isotropic phase. At even higher concentration, the spaghetti strands self-assemble into a polydomain nematic liquid crystal, where the domains are entangled with each other. Under anhydrous condition, the liquid crystalline phase can be processed into continuous highly aligned fibers of pure SWNTs without the aid of surfactants or polymers. By using a new fluorescent staining technique, we measure the rotational diffusivity and persistence length of SWNTs suspended in water with the aid of surfactants, and show that SWNTs behave as Brownian rods.