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**Dissolution of carbon nanotubes in superacids: Modeling and Applications** M. GREEN, A. PARRA-VASQUEZ, N. BEHABTU, C. PINT, R. HAUGE, M. PASQUALI, Rice University, E. KESSELMAN, J. SCHMIDT, Y. COHEN, Y. TALMON, Technion-Israel Institute of Technology — Controlling the phase behavior of single-walled carbon nanotubes (SWNTs) in fluids is critical for the production of SWNT-based macroscopic materials. Yet, dissolution has been a major hurdle for researchers over the past decade. We have previously shown that SWNTs can be dissolved in superacids at high concentration and form liquid crystalline (LC) phases, which are readily processed into fibers and sheets. Here we model the phase behavior of polydisperse SWNTs in superacids using the Onsager excluded volume ansatz a range- dependent rod-rod potential to capture the effects of the solvent. The model indicates that in chlorosulfonic acid (ClSO3H) the attractive van der Waals forces between SWNTs are fully counterbalanced by charge-induced repulsion; therefore, ClSO3H behaves as an athermal solvent for SWNTs, yielding true molecular solutions. This startling result is confirmed by cryo-TEM images of SWNT/acid solutions where the SWNTs are dissolved as individuals. We also show that this acid can even be used to dissolve long (hundreds of microns) nanotubes; these solutions can also form LC phases. Dissolution of such large nanotubes had previously been thought impossible and holds great promise for processing of high-performance SWNT materials.

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