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Extreme electronic sensitivity of carbon nanotubes to internal wetting DI CAO, Arizona State University — It is now possible to pass a solution of an analyte through the interior of individual single-walled carbon nanotube (SWCNT) nanofluidic channels in a planar device connecting two fluid reservoirs. By building field-effect transistor connections onto the SWCNT nanofluidic channel, we have discovered that internal wetting of the SWCNT by pure water turns semiconducting tubes on, and renders them insensitive to back gating. Transistor action is restored when the devices are dried under vacuum. In contrast, external wetting has little effect. Theoretical simulations recapitulate this behavior, showing that the difference in response to internal and external wetting is a consequence of nanoconfinement, which enabled water molecule structure ordering and enhanced the water-CNT interaction. The dipole field of ordered water locks the CNT potential and the water-CNT interaction modifies the electronic structure of the CNT.

Di Cao

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