Research in nano-science and technology is advancing at a breathtaking pace making it difficult to catch up with and absorb even a fraction of the published literature. This situation leads occasionally to certain ‘truths’ and ‘rules’ about the properties and behavior of nanoscale materials, which may be extended to interpret new results without the necessary critical thinking. In this talk, I scrutinize a few examples of such ‘beliefs’ drawing from our own work on carbon nanotubes.

One example relates to the wetting behavior and flow of liquids in carbon nanotubes. The long inner cavity of carbon nanotubes has received attention as a mould for the formation of continuous metallic nanowires with new electrical and magnetic properties. This application was precluded by the high surface tension of most metals, which do not spontaneously wet carbon nanotubes. This observation encouraged the use of mercury as a good Ohmic contact for measuring the electrical properties of carbon nanotubes. However, if mercury were to enter the nanotube under the measurement conditions, it could interfere with the results. And enter it does! We have demonstrated reversible wetting and filling of open single-wall carbon nanotubes with mercury by means of electrocapillary pressure originating from the application of a potential across an individual nanotube in contact with a mercury drop. Wetting improved the conductance in both metallic and semiconducting nanotube probes by decreasing contact resistance and forming a mercury nanowire inside the nanotube. Molecular dynamics simulations corroborated the electrocapillarity-driven filling process and provided estimates for the imbibition speed and electrocapillary pressure. Moreover, the simulations predict scalings and dependencies important for nanofluidics.

Other examples relate to ordering and solidification of liquids in nanotubes as well as the role of mechanical deformations in imaging surfaces using nanotube scanning probes.

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