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Electrostatically induced shape transitions in single wall carbon nanotubes OLEG SHKLYAEV, Department of Physics, The Pennsylvania State University, University Park, PA, 16802-6300, USA, VINCENT CRESPI, Department of Physics, The Pennsylvania State University, University Park, PA, 16802-6300, USA, ERIC MOCKENSTURM, Department of Mechanical and Nuclear Engineering, The Pennsylvania State University, University Park, PA, 16802-6300, USA — We investigate a transition of electrically charged single wall carbon nanotubes from a collapsed to an inflated configuration caused by electrostatic repulsion between the tube walls. If the charge on the tube is large enough then Coulombic repulsive forces, together with the elastic forces overcome Van-der-Waals attraction and convert the tube from a collapsed to an inflated configuration. If the radius of the tube is such that the collapsed configuration is metastable and the inflated state is energetically favorable, then the collapsed-to-inflated transition in one tube section will cause successive inflation of the neighboring sections and result in propagation of the transition region along the tube. If the applied voltage is tuned so that the collapsed and inflated configurations are degenerate, then various mechanical response functions diverge. At this point, a single atom encapsulated in a capped carbon tube may substantially shift the collapsed-to-inflated transition region. Thus, we suggest a system which may be tuned to provide a macroscopic response to the presence of a single atom.

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