Carbon nanostructure based mechano-nanofluidics

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The emergence of the field called nanofluidics in the last decade has led to the development of applications such as water desalination, ultrafiltration and osmotic energy conversion. Most applications make use of carbon nanostructures, e.g. carbon nanotubes, graphene and graphene oxide. Such applications are based on properties of the material/structure such as permeability and flow resistance. Recently, theoretical studies reveal that for carbon nanotubes and graphene, their transport properties for water are deeply related to their intrinsic mechanical properties such as phonons. For both materials, the coupling between water and phonons could lead to enhancement in diffusion coefficient as large as 300%. Since there exist many methods to control the phonons and it is believed that such coupling between phonons and liquid also holds for other carbon nanostructures, these results point to the development of mechano-fluidics in nanoscale objects as a new approach to couple nanofluidics and nanoelectromechanics, especially for carbon nanostructures.