Unusual elastic and inelastic behaviors of carbon nanotubes due to molecular encapsulations: Dynamic force microscopy and spectroscopy studies

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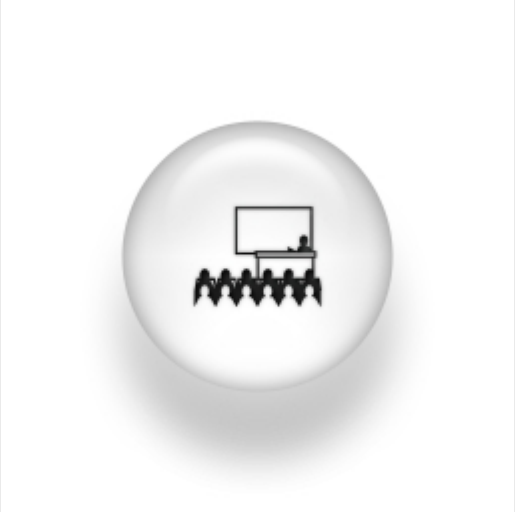

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ABSTRACT:
Atomic force microscopy (AFM) has become versatile and powerful method for imaging both insulating and conducting material surfaces down to the atomic scale. By extending its high spatial resolution and sensitivity to force spectroscopy dimension, mechanical responses of sample materials can be studied with atomic resolution. Using 3D mapping of force and damping fields, we address individual molecules of Dy@C_82 fullerene confined inside carbon nanotubes and control their oscillatory behavior via attractive interactions with the AFM probe tip [1]. Furthermore, we discuss that detailed analysis of individual force vs distance relationships could reveal unusual elastic and inelastic behaviors of carbon nanotubes due to nearly frictionless motions of encapsulated fullerene molecules.