SINGLE-WALLED CARBON NANOTUBES AS NANOTOOLS FOR SCANNING PROBE MICROSCOPIES

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The attachment of multi (MWNT) or single (SWNT) walled-carbon nanotubes to conventional silicon AFM probes has turned out to be an increasingly promising issue aiming at the design of tools for approaching the nanoscopic imaging and/or manipulation regime. From the first introduction of such systems as high resolution imaging probes, a lot of efforts have been developed to optimize the efficiency in the probe fabrication methodology as well as in the understanding of their nanoscale properties and interactions with samples. Many issues like buckling, bending and elastic deformation of such tubular probes as interacting with the substrate have been thoroughly evaluated in order to tailor their properties and improve their performance. In a further and more exciting step, the potential of carbon nanotube probes to be used as biophysical research tools for biomolecular dynamics at the molecular scale needs to be exploited in more detail. In this sense a lot of phenomena can be envisioned based on the functionalization of the very apex of the carbon nanotubes, as for example single molecule manipulation, single-molecule fluorescence, electrochemical triggering of biochemical reactions, etc. The most important step to be solved is the development of a functionalization procedure which is selectively acting on the nanotube apex.
In such context, we describe a new procedure to fabricate nanoelectrode probes of both metallic and semiconducting single-walled carbon nanotubes attached to AFM tips and characterize their electrical and mechanical properties. This work serves as a foundation towards the development of single molecule sensors and manipulators on nanotube AFM tips for a hybrid atomic force microscope that also has single molecule fluorescence imaging capability.