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Telescopic hot double wall carbon nanotube for nanolithography[1]
ADRIAN POPESCU, LILIA WOODS, University of South Florida — Two main challenges in improving the use of an atomic force microscope tip for nanolithography have been identified for all types of methods for surface modification. One challenge is achieving high spatial resolutions, which is directly related to the sharpness of the tip; the other one is the accurate control of the tip-surface distance, which affects the quality of the surface modification. A telescopic hot double wall carbon nanotube for nanolithography that improves the spatial resolution and successfully solves the problem of maintaining a constant tip-surface distance is proposed. The system consists of a finite length outer tube attached to an atomic force microscope cantilever, while the inner tube with length larger than the outer one is free. By studying the heat transfer in the double wall carbon nanotube/surface, it is found that the size of the thermal spot on the surface is mainly determined by the inner tube diameter indicating that high spatial resolution can be achieved if small diameter nanotubes are used. The interaction forces in the system are of van der Waals type and we show that the inner tube is located always at the same energetically favorable distance from the surface. Since the inner tube can move telescopically along the double wall carbon nanotube axis, the tip/surface distance is maintained constant due to the van der Waals interaction, which in turn eliminates the need of an active feedback loop.

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