Carbon Nanotube Electron Windmills

M.Sledzinska, A. Barreiro, A.Bachtold
CIN2, Campus UAB, 08193 Bellaterra

The miniaturization trend affects mechanical devices, which results in the transition from MEMS (microectromechanical systems) to NEMS (nanoelectromechanical systems). This has motivated the researchers to look for new materials, which are suitable for these nanodevices. Due to their properties, such as favourable elastic modulus and tensile strength, high electric and thermal conductivity and low inter-shell friction, multi-wall carbon nanotubes may play an important role in constructing those systems.
As for now the reported drive mechanisms for nanotube rotors and actuators were based on electric field and thermal gradient. Bailey, Amanatidis, and Lambert have proposed a new mechanism to drive a nanotube rotor, which is based upon the torque generated by a flux of electrons passing through a chiral tube [1].
We will present our progress in the fabrication of these nanotube windmills. Devices consist of a suspended multi-wall nanotube, contacted to two gold electrodes. A few outer shells are removed in between the electrodes, leaving the inner tube free to rotate. When passing a current through the devices electrons are forced to tunnel from the outer onto the inner shells. Due to angular momentum conservation, a tangential force is produced that causes the inner tube to rotate.

References:
[1] S.W.D. Bailey, I. Amanaditis, C.J. Lambert, PRL, **100,** 256802 (2008)

Figures: