CHIRALITY EFFECT ON THE MECHANICAL MOTION BETWEEN MWNT SHELLS

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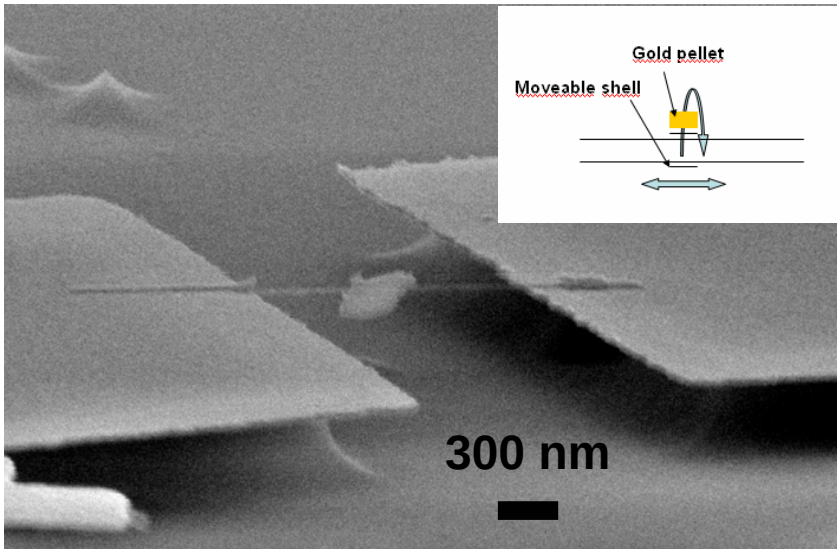
We have fabricated nano-electromechanical devices consisting of a suspended multiwall carbon nanotube (MWNT). The device allows the outermost shell to move and/or rotate along and/or around the MWNT axis (inset of Fig. 1). To make this motion possible, the MWNT has been engineered using the electrical-breakdown method [1, 2, 3]. A gold pellet has been added on the moveable shell in order to observe the motion. It is possible to make the gold pellet slide in a controlled manner along the suspended MWNT using an AFM tip (Fig. 1). The motion of the moveable shell can also be actuated by passing a current through the MWNT. Depending on the device, the moveable shell either moves and/or rotates along and/or around the MWNT axis. The longitudinal, rotational or spiral motion is attributed to the potential barrier of the relative barrier between two shells, which depends on the chirality of the shells [4]. To our knowledge this is the first experimental evidence of the chirality effect on the mechanical motion. The motion of the moveable shell always occurs when a large current flows through the MWNT. At these currents, the gold pellet is often observed to melt, thereby suggesting that the movement is thermally induced.

References:

[1] P.G. Collins, M. S. Arnold, Ph. Avouris, Science **292** (2001) 706.
[2] P.G. Collins, M. Hersam, M. Arnold, R. Martel, Ph. Avouris, Phys. Rev. Lett. **86** (2001) 3128.
[3] B. Bourlon, D.C. Glattli, B. Placais, J.M. Berroir, C. Miko, L. Forro, A. Bachtold, Phys. Rev. Lett. **92** (2004) 26804.
[4] R. Saito, R. Matsuo, T. Kimura, G. Dresselhaus, M.S. Dresselhaus, Chem. Phys. Lett. **348** (2001) 187.

Figures:



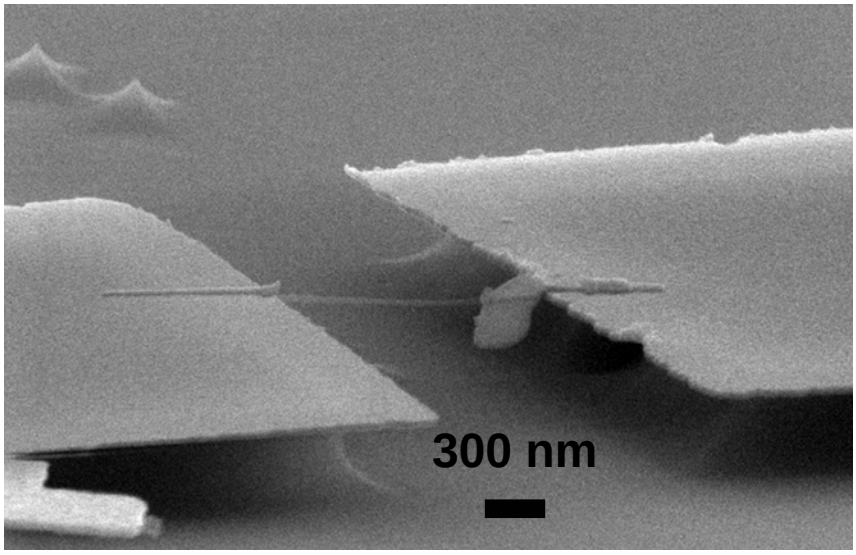


Fig. 1. SEM images of one device with the gold pellet that has been moved using an AFM tip. The inset illustrates the degrees of freedom of the moveable shell structure.