Single-wall carbon nanotubes quantum dots fabricated by controlled electromigration

M.L. Della Rocca, P. Petit, C. Feuillet-Palma, C. Sirtori, P. Lafarge

Laboratoire Matériaux et Phénomènes Quantiques, Université Paris Diderot-Paris 7,
UMR 7162 CNRS
75205 Paris Cedex 13, France
maria-luisa.della-rocca@univ-paris-diderot.fr

The study of electronic transport in single molecule junctions faces the great difficulty to place a single synthesized molecule between two metallic electrodes. Single-wall carbon nanotubes are giant molecules which can be much more easily manipulated in order to study transport at nanometric scale [1,2].

In this work, we present a new method to fabricate single-wall carbon nanotube (SWNT) quantum dot by a controlled electromigration procedure [3,4]. This offers the possibility to investigate an ultrasmall segment of the nanotube.

The device consists of a SWNT coated by a 20 nm-thick, 100 nm-wide metallic wire (Pd) (Fig. 1a). A nanometric sized gap is formed by means of controlled electromigration in the center of the wire resulting in two nanometer spaced electrodes connecting a small portion of SWNT (<10-20 nm) (Fig. 1b). Electronic transport measurements show signatures of quantum dot behavior in the strong coupling limit with a large conductance peak at zero bias which splits at low temperature (Fig. 2). The temperature dependence of such zero bias anomaly indicates that two energy scales are involved. We will discuss the origin of this behavior in the framework of Kondo physics [5].

References

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Figures

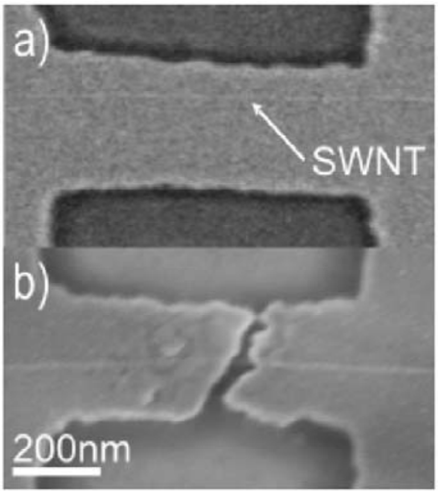

Fig. 1. a) SWNT coated whit a Pd wire.
b) Nanometric sized gap formed by controlled electromigration on the SWNT.

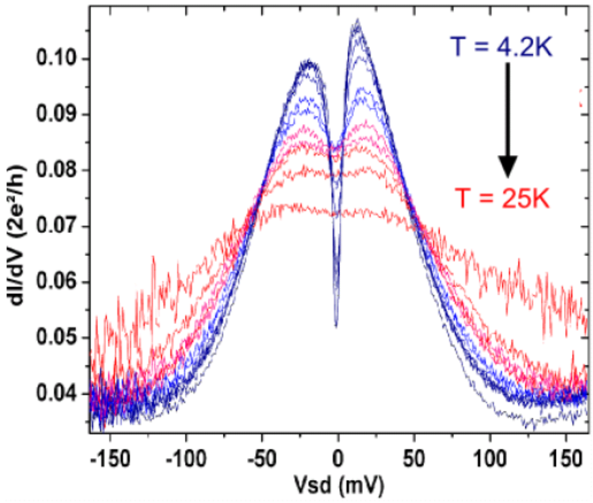

Fig. 2. Zero bias conductance peak splitted at low temperature.