

Workshop on Scanning Probe Nanotechnology

Experimental Physics Department - University of Torino, Italy
16-17 December 2002

Scanning Probe Microscopes: powerful tools to create, manipulate and characterize objects at the nanometer scale

Florence Marchi, University of Grenoble, France

Abstract

Since several years, Scanning Probes Microscopes are widely used to study and to characterize surfaces from micro to atomic scale. More recently, a new approach is intensively developed: using the SPM as a tool for fabrication, modification and/or manipulation of nano-objects [1]. With this original approach, nano-objects can be fabricated or manipulated and just after characterized by a non-destructive technique.

The first part of this talk focuses on the fabrication of nano-objects following by their characterization through three different examples:

- Nano-oxidation of hydrogenated silicon surface by AFM and elaboration of nano-transistors [2].
- CVD assisted by STM: elaboration of Rh nano-clusters [3].
- Surface patterning by SNOM and UV Raman SNOM characterization [4, 5].

For these three examples, their advantages and disadvantages will be listed and discussed.

The second part of the talk focuses on the manipulation of:

- Nano-objects on a surface as carbon nanotubes on a nano-structured surface and how to deduce information about adhesive properties from this kind of experiments [6].
- Elementary particles. Electric charges can be injected in nanostructures or in a dielectric layer by applying a voltage between the AFM tip and the sample. EFM (Electrostatic Force Microscopy) allows characterizing their space-time evolution [7].

References:

- [1] B. M. Eigler, E. K. Schweizer, *Nature* **344**, 524 (1990).
- [2] F. Marchi, V. Bouchiat, H. Dallaporta, V. Safarov, D. Tonneau, P. Doppelt, *J. Vac. Sci. Technol.B* **16**, 2952-2956 (1998).
- [3] F. Marchi, V. Bouchiat, H. Dallaporta, V. Safarov, D. Tonneau, P. Doppelt, *J. Vac. Sci. Technol.B* **18**, 1171-1176 (2000).
- [4] M. K. Herndon, R. T. Collins, R.E. Hollingsworth, P. R. Larson, M. B. Johnson, *Appl. Phys. Lett.*, **74**, 141-144 (1999).
- [5] H. Sand, F. Demongeot, S. Webster, E. Bonera, R. Bennet, I. P. Hayward, F. Marchi, A. Smith, D. N. Batchelder, *J. Raman Spectrosc.*, **33**, 730-739 (2002).
- [6] S. Decossas, G. Cappello, G. Poignant, L. Patrone, A. M. Bonnot, F. Comin and J. Chevrier, *Europhys. Lett.* **53**, 742 (2001).
- [7] C. Guillemot, P. Budau, J. Chevrier, F. Marchi, F. Comin, C. Alandi, F. Bertin, N. Buffet, Ch. Wyon, P. Mur, *Europhys. Lett.*, **59**, 566-571 (2002).