PhD position in Surface Microscopy 2010-2013

Doping of semi-conducting nanowires : direct determination by surface imaging and spectromicroscopy using XPEEM and scanning probes

The Technological Research Division of the French Atomic and Renewable Energy Authority (CEA, *Commissariat à l'Energie Atomique et aux Energies Alternatives*), is currently opening a PhD position in one of its research centre in Grenoble (capital of the french Alps), France. The applicant will be based in the MINATEC campus which houses one of the most advanced Centre in Europe dedicated to nanocharacterization for nanoscience and micro-nanotechnologies (http://www.minatec.com/en).

This thesis focuses on a key issue for the use of semiconducting nanowires in devices: the control of the doping, which calls for the need of suitable measurement methods at the nanoscale. Here, we propose to implement the measurement of the doping level of *individual* semi-conducting nanowires by two surface imaging techniques: the first one, based on photoemission (XPS), is energy-filtered x-ray photoelectron emission microscopy (XPEEM), and uses core-level and valence photoelectrons for imaging, and well suited for the study of nanowires [1]. The second one is Kelvin Force Microscopy which enable local work function measurements. The use of such direct, non-destructive, spatially-resolved ultra-high vacuum techniques on individual nanowires will be assessed regarding their respective benefits and complementarities to other emerging methods like TEM holography or atom-probe tomography (also available in the MINATEC Centre). The key issue of surface preparation of the nanowires will be refined on the basis of recent successful experiments (see Fig. 1). Finally, the international and multi-cultural framework of MINATEC (laboratories, engineering schools, spin-off companies) driven by innovation, will enable to the applicant the development of transverse skills.

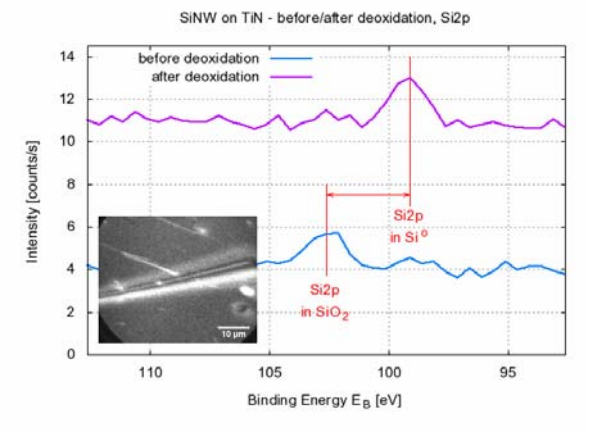

Fig. 1 –XPS Si2p micro-spectra acquired with the XPEEM instrument on an individual, 500 nm diameter Si NW on TiN, before and afetr deoxidation (Excitation : AlKa1 raidation).

[1] A. Bailly, O. Renault, N. Barrett *et al.*, *Nano. Lett.* **8** 3709 (2008).

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French description of the topic also available at http://www-instn.cea.fr, rubrique « Direction de la recherche Technologique », Département Plate-Forme Technologique Silicium, reference SL-DRT-10-0901.

Deadline for sending applications : 15/04/2010