NÉEL INSTITUTE Grenoble

Topic for Master 2 internship – Academic year 2018-2019
Nanofabrication of SPM electrostatic shielding cantilever-tips

General Scope: Electrical measurements on nano-objects at microscopic scale via Scanning Probe Microscopy (SPM) for examples, Electrostatic force, Kelvin probe force, and Piezoresponse force microscopy (EFM, KPFM, PFM) have a major impact on understanding the fundamental working principle of nano-piezotronics, mesoscopic circuits or biological structures. Improving the sensitivity and spatial resolution; which are critically determined by the cantilever-tip of the SPM instrument, is one of challenging issues.

Research topic and facilities available: The present project focuses on nanofabrication and characterization of the SPM electrostatic shielding cantilever-tips. Such sensors will remove the electrostatic background and avoid the smearing effect due to the cross-coupling from surrounding materials having different electrical potential, such as electrical contacts. For this reason, the lateral spatial resolution of the local electro- and piezo- potential probing measurement via EFM, KPFM and PFM. In addition, these coaxial-like cantilever-tips could also strongly reduce the disturbing of electrochemical reaction induced by the biasing voltage for the SPM in liquid environment. Figure 1 is this type of cantilever-tips developed for the local investigation of the electrical properties in liquid of biopolymers like cellulose and of III-N nanowires.

For nanofabrications, the internship student will participate in thin film deposition (Atomic Layer Deposition), electron beam lithography, and Focused Ion Beam using NanoFab cleanroom facilities. Electrical characterization of the coaxial behavior will be tested and their applications to electrical SPM measurements will be performed at the PCI-ICMG and Néel SPM platforms

Possible collaboration and networking: Ecole central de Lyon, Cermav-Grenoble, CEA-Grenoble, Néel-Grenoble

Possible extension as a PhD: Possible

Required skills:
The candidate should have knowledge on nanofabrication (UV-, SEM-lithography) with a strong background on material and physics. Interests on electric and computing simulation will be also appreciated.

Starting date: March 2019

Contact:
Name: Rudeesun Songmuang
Institut Néel - CNRS, e-mail: rudeesun.songmuang@neel.cnrs.fr
Name : Franck Dahlem,
Ecole Centrale de Lyon / UGA and CERMAV / LTD, email : franck.dahlem@cermav.cnrs.fr