4: E-Beam Lithography and Focus Ion Beam (FIB) techniques for micro- and nanofabrication

Jean-François Motte, Institut Néel - CNRS and UGA

Electron Beam Lithography (EBL) is intensively used for research in a variety of domains of nanosciences. Both the flexibility and the resolution of EBL are used to make special and innovative devices in order to study quantum effects and other novel physics phenomena at very small dimensions. Typical applications are ballistic electron effects, electron energy quantization in very small structures, hybrid structures and Single Electron Transistors. Feature sizes of 30 nm are routinely obtained with this technique.

Another aspect of nanofabrication is direct writing of nanostructures with Ga ions using the Focus Ion Beam (FIB) technique.

Dedicated to EBL novice users, this practical will take place in the laboratory “Institut Néel” (Polygone CNRS) in the Nanofab clean room. The students will work on Scanning Electron Microscope (SEM) equipped with EBL and FIB facilities.

During the practical, the principles of electron optics, electron beam deflection, electron-solid interactions and proximity effects in EBL will be introduced. Afterwards, the students will realize a shadow mask in a bilayer resist PMMA-MAA (Fig. 1) in order to fabricate metal-superconductors nano-junctions with the angle evaporation technique.

Some direct writing on circuits with the FIB technique will eventually be performed.

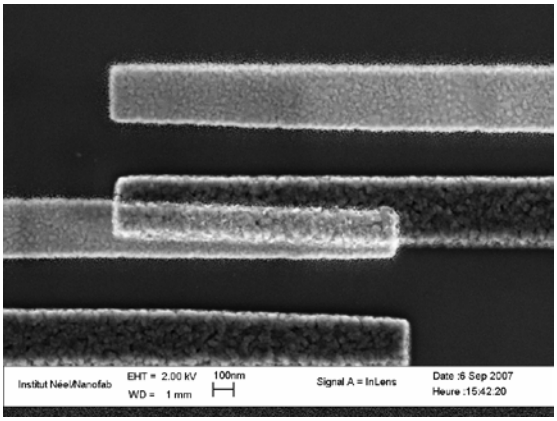

Fig 1 :

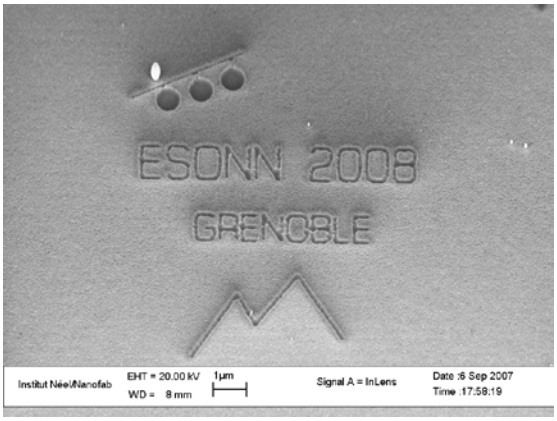

Fig 2 :

Fig. 1: SIN nano-junctions (Al/AlOx/Au) fabricated with angle evaporation technique (ESONN 2007)

Fig. 2: Direct FIB writing on Silicon during ESONN 2007.