Wolfson Nanomaterials & Devices Laboratory

Faculty of Technology, University of Plymouth

The Wolfson Nanomaterials & Devices Laboratory at Plymouth University is a cleanroom based lab for leading edge research in nano-spintronics, computer memory and data storage technology, nano-functional materials and biosensors. We are unique in the UK universities to have device-quality spintronic film deposition, device microfabrication, magnetic and magnetotransport as well as nano-scale metrological characterisation in a single outfit.

Nordiko 9550 spintronic deposition tool

Acquired with funding support from FP6 and DTI MNT, it is a key piece of equipment for leading edge research in spintronics. It has six sputtering targets providing the capability of depositing six different materials in the same evacuation. The load-lock is equipped with a robot arm and a cassette for sixteen 4” wafers, which provides a semi-production throughput and is also essential for maintaining the required ultra high vacuum (of $10^{-9}$ Torr range) in the chamber. The machine is fully computer controlled via an OS9 PC, which enables automatic pump-down and programmable deposition sequence. It is currently configured for the deposition of magnetic tunnel junctions with MgO barrier and other advanced spintronic films and devices. Three other deposition tools also available in the lab for a large number of variety of materials.

Micro/nano-fabrication

The lab is equipped with a complete suite of microfabrication facility including an OAI 500 mask aligner, an ion miller, photoresist spinner and wet benches for the fabrication of submicron feature sized devices. We also have the experience/expertise for carrying out nanofabrication of devices using e-beam and FIB in collaboration our collaborators.

Atomic force microscope and electron microscopes

The AFM has three modes of operation - 3D atomic force microscope (AFM), magnetic force microscopy (MFM) and nano-scale scanning probe lithography. Its main applications include nano-scale metrological characterisation of films and devices, such as surface morphology, surface roughness, grain sizes and film thickness, micro-scale magnetic domain characterisation (MFM) and nano-scale lithography. A transmission electron microscope (TEM) and two scanning electron microscopes (SEM) plus a confocal laser microscope are also available in the lab for various structural and device characterisations.

Magnetic and spin transport measurement

Built by our final year project students with funding support from research projects, both instruments are fully computer controlled with Labview software and GPIB interface. The VSM has a sensitivity of $10^{-5}$ emu and can measure films as thin as 1 nm. Its 7 inch electromagnet can produce a uniform field up to 8 kOe and is also used for magnetic field annealing of spintronic films and devices. The 4-point probe system uses a Keithley 6221 source meter as a constant ac/dc current source with resolution of 10µA and a Keithley 2182 nano-voltmeter for signal acquisition with nanovolt sensitivity. It has a maximum measurement field of 2 kOe. The instrument enables us to perform two types of measurements for nanoscale spintronic devices – the magneto-transport measurement and the spin torque transfer measurement.