Manufacturing and device fabrication facilities

The Emerging Device Technology (EDT) research group has a class 10,000 clean room occupying about 65 square meters of space. The room is for research into thin film materials and electronic circuits based on these thin films and other materials. The room is kept clean by constant circulation of fully air conditioned filtered air. Defects in devices and films are therefore effectively removed by the absences of dust.

The £1 million clean room facility has been funded by industry, the University and EPSRC. Much of the equipment in the room has been donated by industry complemented with substantial funding from EPSRC through a JREI award.

The users of the room are postgraduate students and other researchers in the EDT group, as well a collaborators from around the university and elsewhere in industry and academia from around the world.

The picture below shows a view of the clean room in operation.

The clean room facility holds three sputtering systems including one dedicated to the deposition of high temperature superconductors, an evaporator, a plasmer etcher, an ion beam milling machine and an oxygen asher. In addition, extensive facilities are available for patterning and cleaning substrates and films.

There is also collaboration around the university in the area of deposition of thin films by laser ablation. Within the university there are also extensive instrumentation for characterising films and materials using for example SEM, AFM, TEM and X-ray facilities. In addition the researchers in the EDT group have access to direct electron beam lithography, focussed iona beam milling and an STS plasma etcher housed in the Department of Mechanical Engineering.

The photograph below shows the Leybold Z550 sputtering system. This system has the ability to sputter over five inch diameter areas using both d.c. and r.f. sputtering. There are five substrate positions and five targets enabling complex multilayer materials to be built up. The whole system is under computer control.

The photograph below shows the sputtering system used for making superconducting thin films. The system has an cylindrical target used in an off-axis geometry. It is able to produce superconducting thin films on both sides of a substrate of up to two inches in diameter.

In the clean room there are three processes for patterning thin films, one by wet etching, another by ion beam milling and a third by reactive ion etching. The ion beam miller has a secondary ion mass spectrometer which gives information about the material being milled at a particular moment in time.

A Karl Suss MJB3 mask aligner is used with masks up to 100 mm square to define the shape of the device to be made. The photograph below shows a view of the clean room wet bench housed in a laminar flow cabinet with the operator using an optical microscope. In the background is the Karl Suss mask aligner.

There are a number of different materials which are processed in the clean room including thin films of superconductors, ferroelectrics, dielectrics and metals. Many of these materials are used in the EDT groups device program or processed in conjunction with our collaborators.

Superconducting materials are used in our programs on fundamental studies of superconductors at high frequencies as well as our superconducting microwave device program. Ferroelectrics are of interest because their properties can be changed by the application of an electric field. This enables the production of smart, adaptive, microwave systems.

The picture below shows a superconducting resonator developed using equipment in the clean room. The resonator is the basic building block of the superconducting filter work in the EDT research group.