

## **Pictures of the instruments available at the Physics Department**



**Dell Computer Cluster**

The newly purchased computer cluster consists of 4 Dell Blade Servers, each server has a PE M600 Quad Core Xeon E5450 processor, 2x146 GB SAS HD, and 8 GB RAM.



**Physical Properties Measurement System (PPMS)**

This system is designed to perform electrical and magnetic measurements. The electrical module consists of measurements of DC Resistivity and AC transport. The magnetic module consists of the measurements of magnetic susceptibility and magnetic moment using a “Vibrating Sample Magnetometer” (VSM) technique.



### **Torr International Evaporation and Magnetron Sputtering System**

The system is used to prepare thin films by means of physical evaporation, and magnetron sputtering methods.

In the former method, the material is placed in tungsten boat. A high electrical current is used to evaporate the material and create an atomic cloud. The atomic vapor is deposited on a substrate which create a thin film. In the later method, an inert gas is used create a plasma. An electric field between the plasma and the biased target cause the sputtering of the material of the target. The sputtered material is then collected on a substrate forming a thin film. The thin film thickness is measured by a quartz crystal monitor which is placed close to the substrate.



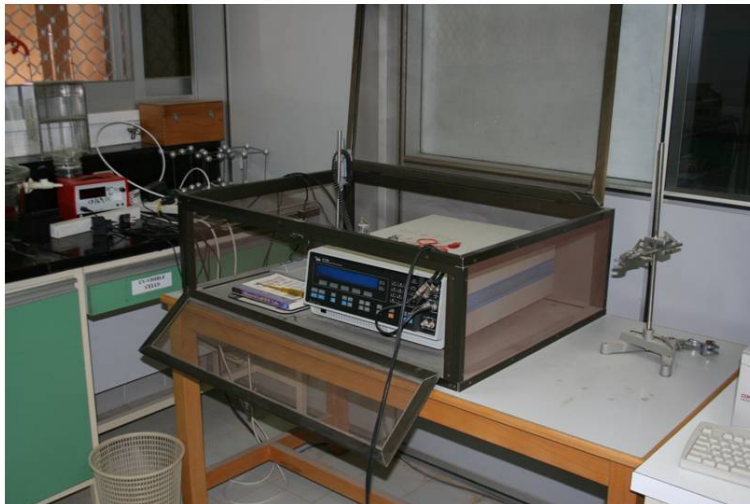
### **Ultra-High Vacuum Nanoparticle System (UHV-NanoSys)**

The nanoparticle system provides a flexible tool to prepare nanoparticles inside an ultra-high vacuum down to an order of  $10^{-9}$ . The nanoparticles are produced using both the sputtering and inert gas aggregation methods. A cloud of atoms of the targeted material is formed inside the nanoparticle source. A high purity inert gas is used to aggregate the atoms and form the nanoparticles. The size distribution of the nanoparticles is determined by the source conditions such as the inert gas flow rate and the volume of the aggregation region. Furthermore, the system contains a high resolution mass filter which enables: 1) to study the size distribution of the produced nanoparticles; and 2) to select nanoparticles with a particular size. The system is designed such that all of the electrical measurements can be performed on the sample while it is still under vacuum. Furthermore, the system contains a closed-cycle helium cryostat which can control the sample temperature between 4.2 and 475K.



**UV/VIS/NIR Spectrophotometer**

This system is used to perform optical measurements such as Transmission, Absorption and Reflection for a range of wavelength 190-3200 nm.



**Impedance-Gain-Phase Spectroscopy**

This system is used to perform AC electric measurements for a range of frequency 0.1Hz -20 MHz. It can be used for thin films and liquid materials.



**Leybold-Univex 300  
Evaporation and Magnetron Sputtering System**

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**"Chemical Vapor Deposition (CVD) System for Carbon Nanotubes Synthesis (MTI Corporation, California, USA).**

This world-class facility is able to synthesize all types of carbon nanotubes, including single and multi-walled nanotubes, and covers a wide range of experimental parameters that control the properties of the as-synthesized carbon nanotubes (temperatures up to 1200 C, gas flow rates from 0 to 1000 sccm, and pressure control from 1 bar to 1 atmosphere)".





**Current-Voltage (I-V) System**

This system is used to perform Current-Voltage (I-V) characteristics of materials. There are one equipment that can go up to 1 A and three others that can go only up to 0.1 A.



**Capacitance-Voltage System (C-V)**

This system is used to perform Capacitance-Voltage (C-V) measurements. It has two modules: one for AC (100 kHz and 1 MHz) measurement and another for quasi-static measurement. It's used mostly for semiconducting and insulating materials.