Applied and Atomic Physics

Structural coatings, Surfaces studies and ionic implantation

The properties of the surface of different substrates are modified by means of two techniques: the first one is ion implar with energies ranging between 100 to 400 keV and the second one is coating of a surface with a hard amorphous carbon fil related material. The aim of the ion implantation techniques is to modify the properties or the structure of the surface of di materials. The purpose of the second one is to grow hard films using different ion beams, to protect the surface from the caused by abrasion or chemical attack. The principal protective coatings so far produced and studied are: hard amorphous c films (a:C) of about 1 mm thickness, N containing a:C films and amorphous carbon rich SiC films. It is particularly relev determine which composition and microscopic structure give the compound greater thermal stability, hardness and /or resistance.

The physical properties of these films and of the modified substrate are evaluated by various methods: Raman spectro to study the amorphous character of the films, XPS and EELS for structural and compositional studies, heavy ion beam tech (HIRBS and ERDA) to determine the concentration of different elements in the film and on the treated surface and po annihilations spectroscopy (PAS) to estimate the size of clusters forming the amorphous matrix. Tribological properti studied measuring indentation hardness, elastic modulus, wear resistance and scratch damage.

In the last years, a wide range of new carbon structures (from polymeric to a-C) has been prepared from fullerene C_{60} high pressures and temperatures. It has been demonstrated that high-pressure-induced polymerization or amorphization o C_{60} gives as a result superhard carbon structures with very interesting electrical behaviors. In our laboratory, the high pr and high temperature are replaced by a dynamic process of deposition of fullerenes with different energies, inducing between carbon atoms of neighboring C_{60} molecules, forming carbon films with different short range organization depend the ion beam energy.

Hydrogen-free carbon films have been produced accelerating C_{60} ions on silicon substrates. C_{60}^{+} ions were obtained fullerene powder at high temperature using a filament-discharge ion source. C_{60} ions have been accelerated to different er (from 100 to 2000 eV) on the substrates. The obtained films have been characterized by EELS, Raman spectroscopy, PAS electrical resistivity and indentation hardness measurements.

During the last years, several developments have been performed using a heavy ion beam in the analysis of m (ERDA and HIRBS techniques), in particular, in the determination of the concentration profile of elements in the zone near surface of the material (around one micron).

At present our main objective is to reduce the difficulties connected with the ERDA technique, for example the gas ha system of our detector, the data analysis and the complicated experimental setup in general. To fulfill this we planned di tasks such as: improving the gaseous detector, developing a new data acquisition systems based on a standard personal co (PC) and using a particular software for data analysis, and finally the installing a dedicated scattering chamber. In summa principal purpose is to develop a reliable experimental setup, which could be used by different groups without major difficu get high quality analytical results as fast as possible.

In the last years we used the very heavy ion beams of Iodine at 127 MeV energy with the ERDA technique. This increase considerable the mass range and make it possible to study the concentration profile from hydrogen up to Cu with constant sensibility. The technique call HIERDA (Heavy Ion ERDA) was used to analyze diamond film and polymeric mate