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 implantation with energies ranging between 100 to 400 keV and the second one is coating of a surface with a hard amorphous carbon film or a related material. The aim of the ion implantation techniques is to modify the properties or the crystalline structure of the surface of different materials. The purpose of the second one is to grow hard films using different ion beams, to protect the surface from the wear caused by abrasion or chemical attack. The principal protective coatings so far produced and studied are: hard amorphous carbon films (a:C) of about 1 mm thickness, N containing a:C films and amorphous carbon rich SiC films. The main idea is to establish a correlation between physics-chemical and tribological properties of these films. It is particularly relevant to determine which composition and microscopic structure give the compound greater thermal stability, hardness and/or wear resistance.

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

During the last years, several developments have been performed using a heavy ion beam in the analysis of material (ERDA and HIRBS techniques), in particular, in the determination of the concentration profile of elements in the zone near of the 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 handling system of our detector, the data analysis and the complicated experimental setup in general. To fulfill this we planned different tasks such as: improving the gaseous detector, developing a new data acquisition systems based on a standard personal computer (PC) and using a particular software for data analysis, and finally the installing a dedicated scattering chamber. In summary, the principal purpose is to develop a reliable experimental setup, which could be used by different groups without major difficulties to get high quality analytical results as fast as possible.