Chemical reactions investigation at the electrode / electrolyte interface through photoemission and related surface techniques

Andrea Giacomo MARRANI, Department of Chemistry, "Sapienza" University of Rome

The interface between a metal or a semiconductor and an electrolytic medium plays a fundamental role in determining the properties of electrochemical and photoelectrochemical devices. Detailed knowledge of the electronic structure of the electrode material and the interfacial composition of the electrolyte requires techniques that are sensitive to the surface, such as photoelectronic spectroscopy (XPS / UPS) and X-ray absorption (XAS). In addition to the high surface sensitivity (d <10-20 Å), these techniques have a peerless ability to discriminate the chemical state of all the elements present.

Specific examples of "electrified" interfaces in which photoelectron spectroscopy is widely used are electrodes for dye solar cells and for various types of lithium batteries. In both cases, the ex-situ application of the spectroscopic method of investigation facilitates the understanding of the electrode reaction mechanisms and the interaction between the surface and all the species with which it comes into contact (dyes, redox mediators, solvent, lithium salts, additives, etc.), as well as parasitic and degradation reactions (recombination processes, formation of undesirable stable intermediates). This contribution will present examples of the activity carried out in this area by our research group.