The Contribution of Surface Analysis to Corrosion Science : Historical Background and Current Status

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The aim of this lecture will be to review the contribution of surface analytical techniques to the progress made in corrosion science. The three parts of this presentation will be the following:

- The principles of the methods.
  The principles of the surface analysis techniques will be briefly presented and the reasons why they are particularly relevant to research in corrosion science will be explained. Among the different surface analytical techniques used in corrosion research, the emphasis will be placed on Surface Chemical Analysis by X-ray Photoelectron Spectroscopy (XPS, or ESCA, Electron Spectroscopy for Chemical Analysis) and Surface Structural Analysis by Scanning Tunneling Microscopy (STM) and Atomic Force Microscopy (AFM).

- An historical perspective.
  Without being exhaustive, this part will give an overview of the development of the application of surface analysis to corrosion science, with the milestones, corresponding to significant advances in the understanding of corrosion phenomena. Here the emphasis will be placed on passivity, a field in which surface analysis has made a considerable contribution (chemical composition and thickness of passive films, chemical states of alloyed elements in passive films on alloys, and the role of alloyed elements, bilayer structure, crystallinity of passive layers, epitaxy, growth mechanisms, role of the surface defects). Examples from other areas will also be included: adsorption, low temperature oxidation, localized corrosion, and corrosion of electronic materials and devices. Contributions from other techniques will also be presented, but in a less detailed manner (SIMS, Raman Spectroscopy, IRRAS, Ellipsometry, XANES, GA-XRD, and nuclear methods (NRA, RBS and radiotracer measurements)).

- The current status.
  The present (and future) needs in surface analytical techniques for solving today's (and tomorrow's) problems in corrosion science will be briefly discussed, and then included in the concluding remarks.