

Recent Progress in Understanding Corrosion and Protection Mechanisms at the Nanometric Scale

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Understanding the early stages of corrosion of metal surfaces at atomic or nanometric scale is a key to a better design and an improved control of engineering metals.

This lecture will focus on a surface science approach of corrosion and protection of metals and alloys.

The following topics will be addressed:

- Nanostructure of ultra-thin oxide layers (passive films) on metals and alloys,
- Local electronic properties of passive films,
- Mechanisms of initiation of localized corrosion, with emphasis on the role of surface defects in localized attack leading to corrosion,
- Key features of organic molecule-metal surface interactions for corrosion inhibition

The importance of using advanced surface characterization techniques will be emphasized, including *in situ* Scanning Tunneling Microscopy (STM), Scanning Tunneling Spectroscopy (STS), X-Ray Photoelectron Spectroscopy (XPS), Time of Flight Secondary Ions Mass Spectrometry (ToF-SIMS) combined with electrochemical measurements. The interplay of atomistic modeling/simulation with the experimental approach will be discussed.