

Electrochemical AFM: probing chemical reactions at the nanoscale

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Mechanistic insights of chemical processes cannot be achieved without a detailed multiscale characterization. Within this context, electrochemical AFM (EC-AFM) proved to be particularly effective. Described for the first time more than twenty years ago, this technique has been recently gaining attention, thanks to the development and availability of user friendly commercial equipment. EC-AFM allows to build an electrochemical cell inside the microscope sample holder. The AFM tip scans a surface which behaves as electrode, while an electrochemical process is in progress. Consequently, EC-AFM offers the possibility to monitor a variety of systems in operando, visualizing the real-time effects of electrochemical reactions involving either reactants or products at the solid-state. Among the others, it has been successfully applied in corrosion, electrodeposition, and energy storage fields.

Here, we will give a brief overview of EC-AFM main features, highlighting its potentialities and limits. Case studies concerning different areas of application will be discussed, and development perspectives will be presented.