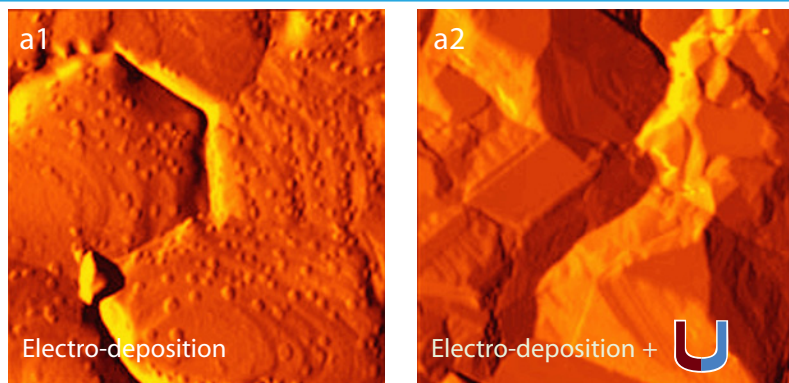


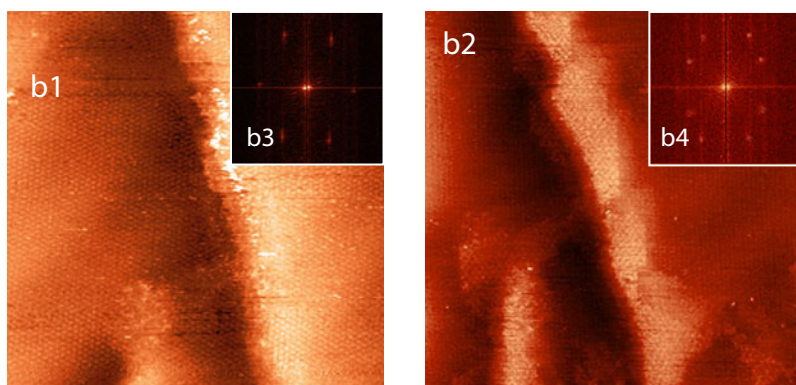
Electrochemistry at the nano-scale

Electrochemical (EC) technologies attract constantly rising interest because it is the way for controlled modifications of the surface even with atomic precision. EC deposition is a widely used approach for creation of thin metal films with unique properties. On the other hand EC dissolution allows imitation and study of corrosion processes. Scanning probe microscopy i.e. Atomic Force Microscopy (AFM) and Scanning Tunneling Microscopy (STM) techniques open up the possibility to monitor the nanometer scaled changes occurring at the surface during an EC modification. With the [NTEGRA nanolaboratory](#) one can run various EC experiments in highly specialized conditions.



AFM images of copper films electro-deposited on Au (111) without magnetic field (a1) and in magnetic field ($B = 0.1$ T) (a2). Scans were obtained by using [CSG01 probes](#). The *in situ* AFM investigations were performed with the [NTEGRA Aura](#) setup in the MFM configuration. Scans size $2 \times 2 \mu\text{m}$.

As an example the images (a-series) show that the external magnetic field (MF) strongly influences the Cu deposition process. Due to magneto-hydrodynamic (MHD) convection and some other effects of interaction of ions with external MF the electro-deposition occurs much faster.



STM images of the under potential deposition (UPD) of copper on Au (111) in sulfate solution before negative shifting the sample potential (b1) and afterwards (b2). After Fourier filtration (b3, b4), it is obvious that negative shifting leads to the replacement of sulfate anions by Cu adatoms: atomic structure typical for sulfate ($\sqrt{3} \times \sqrt{3}$)R30° changes to structure (1×1) typical for pseudo morphic Cu monolayer. Scans size 30×30 nm.

The b-series demonstrate the possibilities of STM. During Cu electro-deposition it is allowed to see the formation and destruction of a lattice with the copper adatoms and the sulfate anions. As a result, the Cu monolayer replaces the sulfate anions. The *in situ* STM investigations were performed with the [NTEGRA](#) setup designed for electrochemical measurements.

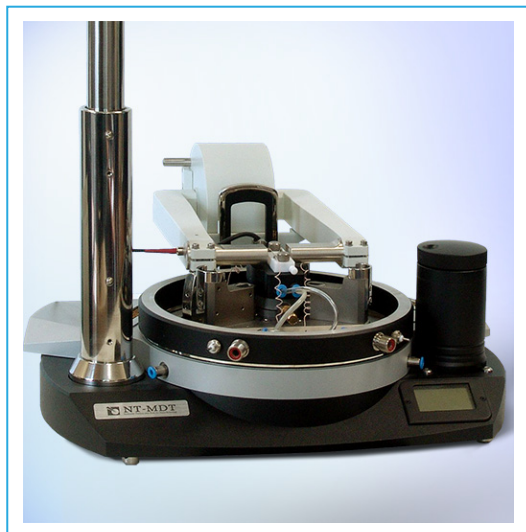
Hardware information

Electrochemical cell



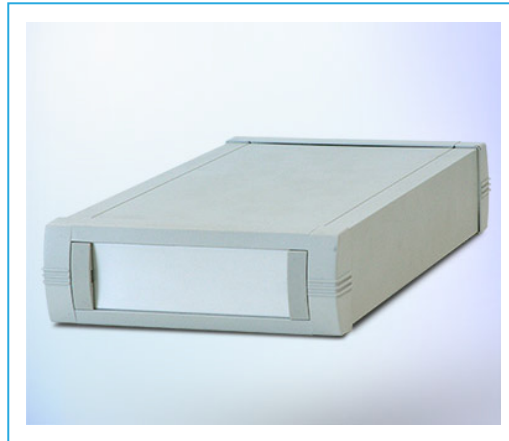
EC cell for STM and AFM experiments in controlled environment provides thermostabilization. Hermetic cell is optionally available.

SPM



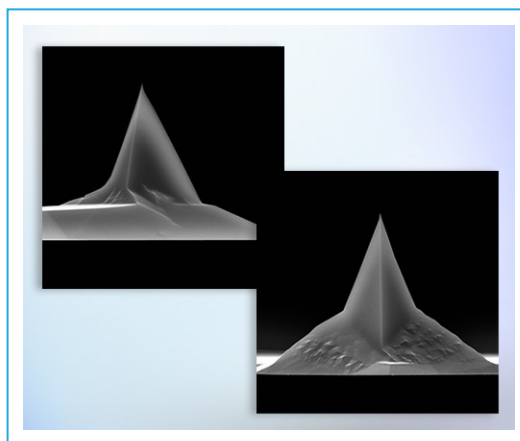
NTEGRA AURA performs measurements in low vacuum or under controlled atmosphere environments. **NTEGRA AURA setup** in the MFM configuration allows to perform EC experiments in external magnetic field.

Electronics



Bipotentiostat is a computer-controlled module for electrochemical experiments in potentiostatic, potentiodynamic and galvanostatic modes.

Probes



Conventional High Resolution AFM “**Golden**” Silicon Probes (**CSG01**) for contact mode are available with different coatings (Au, Al, PtIr, TiN, Au, diamond doped conductive e.t.c.) and tipless. Probes without any coating and for non-contact modes can be supplied as well.