Surface and Interface Science

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Surface Analysis and Surface Chemistry

Selected Recent Projects

Structure, Reactivity, and Catalysis of Alloy Surfaces

- Chemisorption and Catalysis at Ordered Alloy Surfaces: Pt Alloys
- Characterization and Allying Behavior of Bimetallic Systems
- “Tuning” Chemistry at Surfaces: Chemisorption Properties of Pd Monolayers and Ultrathin Films

STM Studies of Site-Directed Chemistry at Alloy Surfaces

- Imaging of Bimetallic Pt Surfaces and Atomic Level Control of Reactivity
- Alloy Oxidation and Synthesis of Nanostructured Oxide Overlayers

Surface Chemistry and Catalysis of Au

- Bonding and Oxidation Reactions on Au Surfaces
- Thermal and Electron-Induced Reactions of Hydrocarbons

Radicals and Oxidation Reactions at Organic Interfaces

- Reactions of NO₂ on Ice using FTIR
- Ozone Oxidation of Olefinic Hydrocarbons in Condensed Films

Robotic Assembly of Functional Nanostructures

- Laboratory for Molecular Robotics: Nanomanipulation using AFM
- Underlying Phenomena and Real-Time Monitoring of Particle Manipulation by Mechanical Pushing in Air and Liquids
- Layered Nanofabrication
High-Resolution X-ray Photoelectron Spectroscopy (HR-XPS): Scienta ESCA-300

The Scienta ESCA-300 is a unique high-resolution, high-sensitivity, angle-resolved XPS instrument for chemical analysis of surfaces and nanostructures.
ESCA 300 - the ultimate in high-resolution analysis

- High surface sensitivity
- High speed/detection level
- Low electron-beam damage
- Attached processing and reaction chambers
X-ray photoelectron spectroscopy (XPS)

**Insulators**

- Te-KW Glass
- Fractured *in situ*

- Te(3d)
- Te(3p)
- O(1s)
- K(2p)
- W(4d)

**Polymers**

- Fluropolymer Film

- C(1s)
UHV-VT-STM at LU
High-Sensitivity Low Energy Ion Scattering (HS-LEIS): Qtac 100

<table>
<thead>
<tr>
<th>Ion species</th>
<th>$^3\text{He}^+$, $^4\text{He}^+$, $^{20}\text{Ne}^+$, $\text{Ar}^+$, $\text{Kr}^+$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy range</td>
<td>up to 8,000 eV</td>
</tr>
<tr>
<td>Beam current</td>
<td>1 pA ... 100 nA</td>
</tr>
<tr>
<td>Ion beam raster size</td>
<td>4 x 4 mm$^2$</td>
</tr>
<tr>
<td>Minimum spot size</td>
<td>&lt; 30 μm</td>
</tr>
<tr>
<td>Detection limit (for Au)</td>
<td>&lt; 100 ppm</td>
</tr>
</tbody>
</table>
Qtac 100 energy analyzer

http://www.iontofusa.com/leis-energy.htm
Calipso features

**Time-of-Flight Mass Filter**

In conventional LEIS, secondary ions, generated by the impact of the noble gas ions, lead to a high background for low scattering energies.

This background reduces dynamic range and detection limits, in particular for light elements.

The OQAC 400 is equipped with a time-of-flight detection system, which separates the scattered noble gas ions from this background. This unique feature significantly improves the elemental detection limits and the dynamic range of the instrument.

![LEIS spectrum of a technical polymer without time-of-flight mass filtering](image)

![LEIS spectrum of the same sample with time-of-flight mass filtering showing significantly improved detection limits](image)

**Surface Imaging**

By rastering a focused ion beam over the surface, mass resolved elemental images (chemical maps) can be obtained.

![LEIS images of a metal structure showing the Ti and Cu distribution (top) and an overlay (bottom)](image)

Field of view: 2 x 2 mm²