IAP Seminar

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Tuesday, 26th March 2024, 16:00 s.t.
TU Wien, Institut für Angewandte Physik, E134
1040 Wien, Wiedner Hauptstraße 8-10
Yellow Tower „B“, 5th floor, SEM.R. DB gelb 05 B

Probing Chemistry at the Ångström-Scale via Scanning Tunneling Microscopy Combined Tip-Enhanced Raman Spectroscopy

My research group is interested in investigating how local chemical environments affect nanostructure properties with Ångström scale resolution. This talk will start with Tip-Enhanced Raman Spectroscopy (TERS), which affords the spatial resolution of traditional Scanning Tunneling Microscopy (STM) while collecting the chemical information provided by Raman spectroscopy. By using a plasmonically active material for our scanning probe, the Raman signal at the tip-sample junction is incredibly enhanced, allowing for single-molecule probing. This method, further aided by the benefits of ultrahigh vacuum, is uniquely capable of controlling localized plasmons via an atomistic approach. We are able to obtain (1) single-molecule chemical identification; (2) structural identification of new synthetic 2D materials; (3) atomic-scale insights into the oxygen reactivity of 2D materials; (4) local strain effects in an organic/2D materials heterostructure. By investigating substrate structures, superstructures, 2D materials lattices, and the adsorption orientations obtained from vibrational modes, we extract novel surface-chemistry information at an unprecedented spatial (< 1 nm) and energy (< 10 wavenumbers) resolution. Another application of localized surface plasmons is to achieve site-selective chemical reactions at a sub-molecular scale. We recently selectively and precisely activated multiple chemically equivalent reactive sites one by one within the structure of a single molecule by STM tip-controlled plasmonic resonance. Our method can interrogate the mechanisms of forming and breaking chemical bonds at the Ångström scale in various chemical environments, which is critical in designing new atom- and energy-efficient materials and molecular assemblies with tailored physical and chemical properties.

All interested colleagues are welcome to this seminar lecture (45 min. presentation followed by discussion).

Friedrich Aumayr
(LVA-Leiter)

Gareth S. Parkinson
(Seminar Chair)