

Dynamic Force Microscopy with Atomically Defined Probe Tips

Harry Mönig

Institute of Physics, University of Münster, Münster, Germany

The implementation of atomically defined probe tips in non-contact atomic force microscopy (nc-AFM) not only provides increased resolution and reproducibility, but also enables precise control over chemical interactions. In conjunction with ultra-sensitive qPlus force sensors, this allows imaging organic nano-structures with sub-molecular resolution, which has led to a new era in surface chemistry. Highlighting their potential for elemental and chemical discrimination, presented examples include the use of oxygen-terminated copper tips in imaging the sublattices and defect structures of heterogeneous surfaces. Beyond imaging, the atomic-scale control of probe tips allows for tailored force spectroscopy and tip manipulation experiments with picometer and piconewton resolution. Controlling nc-AFM probe tips on an atomic level constitutes a powerful opportunity to standardize such experiments, which greatly improves the fundamental understanding of surfaces and interfaces toward applications ranging from heterogeneous catalysis to electronics, and energy conversion where the local atomic structure largely determines the performance of the material systems and devices.