MI 6: Scanning Probe Microscopy

Time: Tuesday 11:30–12:00 Location: EMH 225

MI 6.1 Tue 11:30 EMH 225

The ReactorAFM: a high-pressure high-temperature NC-AFM for catalysis — Sander B. Roobol, •Matthijs A. van Spronsen, Mirthe Bergman, Peter C. van der Tuijn, Raymond C.T. Koehler, Joost W.M. Frenken, and Irene M.N. Groot — Huygens-Kamerlingh Onnes Laboratory, Leiden University, The Netherlands

To gain fundamental understanding of the mechanisms in catalytic reactions, it is essential to study gas-surface interactions by in-situ microscopy. The ReactorAFM is a novel instrument enabling atomic-scale imaging of oxide-supported metallic nanoparticles under high-pressure, high-temperature conditions. The ReactorAFM is a tuning fork based NC-AFM embedded in a 0.5 ml flow reactor, housed in a UHV system. The instrument operates from room temperature to 600 K and from UHV to 6 bar. A gas system mixes up to 5 gases and controls the flow and pressure, while a mass spectrometer is used for on-line analysis of the reaction products, enabling direct correlation of catalyst structure with reactivity. The force sensor is a miniature quartz tuning fork, which is mounted in the qPlus configuration and has a resonance frequency of 96 kHz. The micro-sized tip is grown by electron beam induced deposition and consist of polycrystalline Pt with carbon impurities. The design of the instrument and the challenges of NC-AFM at high pressure and high temperature conditions will be discussed. In addition, the performance of the instrument is characterized and images of single crystal samples and supported nanoparticles in catalytically relevant conditions will be shown.

MI 6.2 Tue 11:45 EMH 225

Multifrequency AFM with Self-sensing Tunneling Magnetoresistive (TMR) Cantilevers — •Gerald Göring[1], Tobias Meier[2], Alexander Förste[3], Ali Tavassolizadeh[4], Karsten Rott[5], Dirk Meyners[4], Roland Gröger[3], Günter Reiss[5], Eckhard Quandt[4], Thomas Schimmel[1,3], and Hendrik Hölscher[2] — [1]Institute of Applied Physics, Karlsruhe Institute of Technology (KIT) — [2]Institute of Microstructure Technology, Karlsruhe Institute of Technology (KIT) — [3]Institute of Nanotechnology, Karlsruhe Institute of Technology (KIT) — [4]Institute for Materials Science, Christian-Albrechts-Universität zu Kiel — [5]CSMD, Physics Department, Bielefeld University

We describe self-sensing tunneling magnetoresistive (TMR) cantilevers which can be utilized for multi-frequency AFM. Furthermore, we achieve a large scan-range with a nested scanner design of two independent piezo scanners: a small high resolution scanner with a scan range of 5x5x5 μm^3 is mounted on a large area scanner with a scan range of 800x800x35 μm^3. In order to characterize TMR sensors on AFM cantilevers as deflection sensors, the AFM is equipped with a laser beam deflection setup to measure the cantilevers deflection independently. Images obtained on different samples such as calibration standard, optical grating, EPROM chip, self-assembled monolayers and atomic step-edges of gold demonstrate the high stability of the nested scanner design and the performance of self-sensing TMR cantilevers.