Universität Regensburg

FAKULTÄT FÜR PHYSIK
Graduiertenkolleg
Elektronische Eigenschaften von
Nanostrukturen auf Kohlenstoffbasis

**Einladung**

**zum**

**Seminarvortrag**

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## "High-resolution NC-AFM imaging with oxidized copper tips: Accessing quantitative bond lengths and intermolecular coupling"


*Abstract:*

Imaging the bonding structure of organic molecules by noncontact atomic force microscopy (NC-AFM) has been a major breakthrough for a fundamental understanding of chemical processes in specific local environments. The methodology involves the atomic scale control of the tip termination by attaching single atoms or molecules (e.g. CO or Xe) to the metallic apex [1-5]. However, these probe particles are only weakly connected at the tip, which results in a considerable dynamic deflection in the experiments. As a consequence, such NC-AFM data show pronounced image distortions, a systematic overestimation of bond lengths, and artificial bond-like contrast features [4-8].

By combining NC-AFM- and scanning tunneling microscopy experiments with density functional theory, we developed an alternative approach of tip functionalization. By slightly indenting the probe tip into oxidized copper substrates and subsequent contrast analysis, allows for the verification of an O-terminated Cu tip (CuOx tip). This tip is chemically passivated and shows a high structural stability due to the tetrahedral configuration of the covalently bound terminal O atom [9,10].

It is shown that the rigidity of the CuOx tip allows to quantitatively determine bond lengths and to access bond order effects in molecular systems. Furthermore, artificial bond-like contrast features, as observed for flexible probe particles, can be excluded for the CuOx tip. Combining this methodology with photoelectron spectroscopy, establishes this approach as a powerful tool for investigations of intermolecular coupling in on-surface chemistry.



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