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S E M I N A R
aus
Halbleiterphysik und Nanotechnologie

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High-resolution scanning probe microscopies on oxides

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Scanning tunneling microscopy (STM) has revolutionized our understanding of surfaces, and the same is true for its younger sibling, non-contact atomic force microscopy (ncAFM) with the qPlus sensor [1]. In this talk, a few examples of employing these techniques for oxide samples will be presented, also serving to demonstrate several STM- and ncAFM-related experimental techniques. When going beyond constant-current imaging, STM can show polarons, i.e., charges localized by coupling to lattice distortions [2], and their influence on surface structure [3] and adsorption [4]. Adsorption of oxygen on TiO_2 surfaces is found to be a multi-step process, where STM can only show the later stages [5], while ncAFM is also able to image delicate molecular species [6], and even deliberately charge and discharge them. Finally, it will be shown that ncAFM with a functionalized tip can also provide information about chemical properties of specific sites, such as the Brønsted acidity of OH groups on In_2O_3.

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[3] M. Reticcioli et al., Phys. Rev. X 7, 031053 (2017)
[4] M. Reticcioli et al., Phys. Rev. Lett. 122, 016805 (2019)
[5] P. Scheiber et al., Phys. Rev. Lett. 105, 216101 (2010)
[6] M. Setvin et al., Proc. Natl. Acad. Sci. USA 114, E2556 (2017)