Metastable Impact Electron Emission Microscopy: Principles and Applications

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The Metastable Impact Electron Emission Microscopy (MIEEM) provides chemical contrast at the surface by electrons emitted due to the metastable He*-atom (^3S) impact. The MIEEM imaging mode, realized by combination of the He* source with the Spectroscopic Low Energy Electron Microscope (SpecLEEM), achieved a spectral resolution < 1 eV and a spatial resolution ~200 nm at 10-20 sec of image acquisition time. In this way a reliable monitoring of spatio-temporal processes within the visual field of view of ca. 50 μm diameter became possible. Few applications will be presented: a study of the chemical composition of insulating islands appearing on La doped $SrTiO_3$ (100) surfaces [1] as well as the first successful employment of MIEEM for probing the spatial distribution of adsorbates on metal surfaces and for the *in situ* imaging of surface reactions [2]. The spectroscopic identification of the reactants during the propagation of the reaction fronts allows to trace the reaction-caused redistribution of the potassium used as an reaction-additive. The redistribution of potassium is explained in terms of the chemically assisted uphill diffusion.

[1] Han Wei, W. Maus-Friedrichs, G. Lilienkamp, V. Kempter, J. Helmbold, K. Gömann and G. Borchardt, Journal of Electroceramics, 8 (2002) 221.
[2] G. Lilienkamp, Han Wei, W. Maus-Friedrichs, V. Kempter, H. Marbach, S. Guenther and Y. Suchorski, Surf. Sci. 532-535 (2003) 132.