Tue-IMA-05: Metastable Impact Electron Emission Microscopy: Principles and Applications

G. Lilienkamp[1] and Y. Suchorski[2]

[1] *Institut für Physik und Physikalische Technologien, Technische Universität Clausthal, Leibnizstr. 4 D-38678 Clausthal-Zellerfeld, Germany*
[2] *Chemisches Institut, Otto-von-Guericke-Universität Magdeburg, Universitätsplatz 2, D-39106 Magdeburg, Germany*

The Metastable Impact Electron Emission Microscopy (MIEEM) provides chemical contrast at the surface by electrons emitted due to the metastable He -atom (^{3}S) impacts. Since the metastable He -atoms excite the outermost surface electrons solely, a high surface sensitivity is achieved. The MIEEM imaging mode was realized by combination of the He source with the Spectroscopic Low Energy Electron Microscope (SpecLEEM) and allowed to achieve a spectral resolution better than 1 eV and a spatial resolution of 200 nm at 10-20 sec of the image acquisition time. In this way a reliable tracing of the spatio-temporal processes within the visual view of ca. 50 µm diameter in a time-window of few min became possible.

Few examples of the MIEEM-application will be presented: a study of the chemical composition of insulating islands appearing on lanthanum 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 has been performed and the reaction-caused redistribution of the initially spatially homogeneous potassium used as an additive has been observed. 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

Tue-IMA-06: Determination of the Intensity/Energy Response Function of a Spherical Mirror Analyser used for XPS Spectrum Imaging

J. Walton[1]

[1] *Corrosion and Protection Centre, School of Materials, University of Manchester, UK*

Two of the main problems associated with obtaining spatially resolved chemical state information from a surface by imaging X-ray photoelectron spectroscopy, are the choice of energy at which images are acquired without missing information, and the occurrence of overlapping photoelectron peaks. Both may be resolved by acquiring many images, so that spectra may be constructed at each pixel in the image data set, and the established methods of data processing used in spectroscopic analysis employed. There is no significant increase in the time required for analysis compared with small area XPS if the noise in the entire dataset is taken into account using multivariate methods, whilst the spatial information is maintained. Furthermore the use of a single value decomposition sorting procedure greatly speeds processing, so that the abstract factors of the spectra as well as of the images may be computed. [1] Quantification of the elements present may then be made by measuring photoelectron peak areas as in spectroscopic mode. In order that data acquired on different instruments may be compared, a traceable and transferable quantification procedure must be used, which requires determination of the intensity/energy response function of the instrument. This has been carried out by comparing spectra from a clean gold surface, constructed from images of 256 x 256 pixels, acquired over a wide energy range, with a spectrum obtained from a gold surface in spectroscopic mode, corrected for the intensity/energy response function using a previously described traceable calibration procedure [2].

1. J. Electron Spectrosc. Relat. Phenom. 148 (2005) 29
2. submitted to J. Electron Spectrosc. Relat Phenom. in April 2005