In situ, site specific and high spatial precision studies of interfaces for correlation of atomic structure to properties

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Content

In situ electron microscopy allows the correlation between atomic structure and properties with high spatial resolution. The effect of electric fields, light, mechanical strain and temperature on structure and properties can be imaged and studied using spectroscopy. The knowledge enable the tuning of properties. Catalytic activity and electrical properties are examples where strain induced effects have a strong influence on the properties. High resolution annular dark field (ADF) scanning transmission electron microscopy (STEM) imaging can provide high resolution (better than 1 Å) and high precision (better than 1 pm) information about the local atomic structure [1]. In situ microscopy can be used to perform electrical conductivity and nanoscale mechanical strain measurements [2, 3]. It is also possible to perform STEM combined with nanobeam electron diffraction to quantitatively evaluate the nanoscale strain distribution [2]. In addition, electric field induced changes on the atomic scale can be studied using in situ microscopy [4]. The precision of the measurement and the quantitative information enables important and theoretical modelling on the same material systems. New aspects of material properties and mechanisms, not obvious from measurements on the macro scale are revealed using in-situ electron microscopy where interfaces, surfaces, geometries and defects affect the material properties on the macro, micro, nano and atomic scale. The knowledge is crucial for the understanding of the mechanisms active on the nano- and atomic scale, the effect of atomic structure on the properties and for the design of materials and devices with tailored properties.

References


