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Imaging and spectroscopy of individual atoms in nano-structured materials

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“Labeling atom by atom” is an ultimate goal of all kind of analytical techniques. Electron microscopes are widely used to visualize the materials with atomic resolution and have long been contributing extensively to the progress of science and technology. It remains, however, a challenge for scientists to see, to identify and to analyze the individual atoms in nano-structured materials. Especially the low-dimensional materials, such as graphene or nanotube, are known to be affected dramatically their physical and chemical properties by their atomic configurations and their interrupted periodicity, such as defects and edges, are needed to be investigated with atomic precision to predict the future device performance.

Recently the possibilities of chemical and electronic state analysis by means of electron energy-loss spectroscopy (EELS) have been pushed to the single atom limit. We have introduced a low-voltage TEM/STEM which has been developed to realize the single atom imaging and spectroscopy in nano-structured materials (1). Examples for the chemical analysis of individual molecules (2), the single atom spectroscopy at graphene edge (3) and the investigation of individual atomic defects (4, 5) will be presented.

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- (1) T. Sasaki et al., J. Electron Microsc. 59 (2010) S7-S13
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- (4) Z. Liu et al., Nature Communications, 2:214 doi:10.1038/ncomms1224 (2011).
- (5) K. Suenaga et al., Physical Review Letters, 108 (2012) 075501

Mardi 26 juin 2012 à 10h30

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