***YY2.01**

Conditions, Prospects and First Results of High-resolution Low-voltage Electron Microscopy - The SALVE Project

Harald Rose, Ute Kaiser
Ulm University, Ulm, Germany

Radiation damage is the fundamental limitation for the attainable specimen resolution of electron micrographs of radiation-sensitive objects. To avoid atom displacement, the accelerating voltage must be lower than the knock-on threshold. At higher voltages, the low intrinsic contrast and the high susceptibility of low-Z materials to knock-on damage prevents for example defect analysis of graphene, carbon nanotubes, and functionalized fullerenes. In order to achieve atomic resolution and high contrast at low acceleration voltages, the correction of both chromatic aberration and spherical aberration is mandatory. The novel Cs/Cc-corrector of the SALVE (Sub-Angstrom Low-Voltage Electron) microscope compensates for these aberrations. In addition, the corrector eliminates the off-axial coma providing a large field of view with more than 2000 equally-well-resolved image points per diameter. The corrector consists of two identical units, each composed of a magnetic quadrupole doublet, a mixed electric and magnetic quadrupole, and two octopoles. The mixed quadrupoles compensate for the chromatic aberration and the octopoles eliminate the spherical aberration The Cc/Cs-corrector has recently been installed into the SALVE microscope and is tested at present. So far, the SALVE microscope was equipped with a monochromator, the imaging omega filter, and the hexapole corrector which only compensates for the spherical aberration and the isotropic off-axial coma. Apart from high-resolution imaging the microscope enables angle-resolved electron energy-loss spectroscopy with high S/N. In addition, we obtain basic information on the atomic structure of defects, their dynamical properties of carbonaceous materials and amorphous silica. Moreover, we shall demonstrate the feasibility of functionalized grapheme as substrate for in-situ experiments and outline the prospects and advantages of the fully (Cc and Cs) corrected SALVE microscope operating in the range between 20 and 80kV.