Stuttgarter Physikalisches Kolloquium

Max-Planck-Institut für Intelligente Systeme
Max-Planck-Institut für Festkörperforschung
Fachbereich Physik, Universität Stuttgart

Ansprechpartner: Dr. Michael Hirscher
E-Mail: hirscher@mf.mpg.de
Telefon: 0711 - 689-1808

Dienstag, 3. Dezember 2013 | **17.15 Uhr** | **Hörsaal 2 D5**

Stuttgarter Max-Planck-Institute, Heisenbergstraße 1, 70569 Stuttgart-Büsnau

Gastgeber: Prof. Peter van Aken, Max-Planck-Institut für Intelligente Systeme, Telefon: 0711 - 689-3529

Applications of low voltage STEM-EELS: from single atom spectroscopy in 2D materials to structure determination in complex oxides

Quentin Ramasse
SuperSTEM Laboratory, STFC Daresbury Campus, Daresbury WA4 4AD, U.K.

Abstract

Modern aberration-corrected scanning transmission electron microscopes have been optimised to provide improved data collection ability and greater flexibility even at low acceleration voltages, and a wealth of complementary analytical signals is now available from a single experiment. When combining Z-contrast and bright field STEM imaging, 2D chemical mapping together with advanced image analysis, it is possible to statistically determine chemical variations in complex oxide structures across a range of compositions, and to relate those to accurately measured atomic displacements. Similarly, the development of so-called 'gentle', dose-controlled STEM techniques has been particularly beneficial for the field of two-dimensional materials. By reducing the acceleration voltage to overcome knock-on damage limitations, many of these structures can be imaged directly at atomic resolution, revealing for instance the propensity of graphene to spontaneously 'heal' itself when perforated. Having shown what atomic species are present and where single atom impurities or defects are located using spectroscopy, some fundamental questions remain: how exactly are these atoms bonded to one another and how do structural differences affect their electronic configuration? Answers to these questions can be provided one atom at a time by EELS fine structure analysis, which can distinguish unambiguously between bonding configurations.