Kokubunji-shi, Tokyo, 185-8601, Japan, [2]Division of Applied Physics, Graduate School of Engineering, Hokkaido University, Sapporo 060-8628, Japan, E-mail：osamu.kamimura.ae@hitachi.com

Using a relatively low-acceleration-voltage (a few tens of kilovolts) electron beam, we are researching diffractive imaging to achieve atomic-resolution observation with little damage to the specimen. Using the prototype microscope, we verified the reconstruction of the object image of a multiwall carbon nanotube (MWCNT) [1]. In this prototype, the resolution during specimen observation was not sufficiently high, and the camera length was fixed. To achieve high resolution imaging using the diffraction pattern with a variable camera length, we have developed a new diffraction microscope based on the conventional scanning electron microscope (Fig.1). The diffraction pattern is recorded on the imaging plate (IP) without projecting the back-focal plane. Development of the new microscope and examples of diffractive imaging will be presented.

[1] Kamimura O., et al., *Appl. Phys. Lett.*, 2008, **92**, 024106.

Keywords: electron microscopy and diffraction, electron diffraction techniques, scanning electron microscopy

MS.34.5

Acta Cryst. (2008). A**64**, C66

Applications of aberration-corrected TEM-STEM and high-resolution EELS in materials research

Gianluigi Botton[1], Christian Maunders[1], Lina Gunawan[1], Kai Cui[1], Lan-Yun Chang[1], Sorin Lazar[1,2]
[1]McMaster University, Materials Sci. & Eng., Canadian Centre for Electron Microscopy, Brockhouse Institute Materials Research, 1280 Main Street West, Hamilton, Ontario, L8S 4M1, Canada, [2]FEI Company, Acthseweg Noord 5, 5600 KA Eindhoven, The Netherlands, E-mail：gbotton@mcmaster.ca

Aberration-corrected electron microscopy has the potential to significantly improve the quality of information retrieved from transmission electron microscopes and to help researchers understand the structure of materials and their defects. In our laboratory, two aberration corrected microscopes have been commissioned and have been used to study several materials ranging from oxides, multiferroic thin films, nanowires, nanoparticles and a variety of quantum structures. With a FEI Titan 80-300 Cubed equipped with an image corrector, located in an ultrastable environment, this instrumentation has demonstrated extremely low drift rates and better than 0.75Å information limit. The stability of the microscope is demonstrated in several examples of work where remarkable improved image contrast has been noted. With high-angle annular dark field imaging, we have been studying polarity of nanowires and nanoparticles as well as defects in layered multiferroic materials. Early results on a double-corrected and monochromated FEI Titan 80-300HB equipped with a SuperTwin lens have demonstrated better than 1.4Å STEM resolution with a monochromated beam of 0.14eV energy resolution. A second instrument equipped with a CryoTwin lens, an image corrector and a monochromator has demonstrated better than 1Å information limit. Results of these instruments installed in our laboratory will be presented. Particular emphasis will be given to the enhanced contrast and benefits of aberration-correction for solving materials science problems. The combined benefits of high-resolution electron energy loss spectroscopy and high spatial resolution will be shown with examples related to materials exhibiting interesting magnetic properties.

Keywords: high-resolution electron microscopy, electron energy loss spectroscopy, perovskites

MS.35.1

Acta Cryst. (2008). A**64**, C66

Comprehensive structural characterisation of local and bulk structure in disordered systems

Daniel T Bowron
Science and Technology Facilities Council, ISIS Facility, Rutherford Appleton Laboratory, Chilton, Didcot, Oxfordshire, OX11 0QX, UK, E-mail：D.T.Bowron@rl.ac.uk

The detailed structure around physico-chemically active atomic sites and their incorporation within a structurally disordered bulk supporting medium is an important aspect of modern materials physics and chemistry. The interplay between these two issues often defines a system's technological properties. Though many experimental techniques have been applied to the challenging task of elucidating this structure over the past few decades, the results have mostly been interpreted in isolation. This has led to a range of conflicting findings in the literature due to the distinctly different and often poorly defined structural sensitivities of the various probes. With the advent of modern inverse modeling techniques, whereby computer simulations are driven to reproduce structural models that are consistent with experimental data, it has now become possible to resolve this problem. Here I will illustrate how to combine the strength of neutron or X-ray scattering for bulk structural studies, with the chemically specific short ranged structural sensitivity of EXAFS spectroscopy. This analytical approach is particularly advantageous as it allows us to compensate for the poor sensitivity of the scattering experiments to dilute components whilst simultaneously removing the need for large numbers of free parameters in modelling spectroscopy data. The technique will be illustrated with results on a range of liquid and glassy systems.

Keywords: scattering neutron, EXAFS spectroscopy, liquids structure

MS.35.2

Acta Cryst. (2008). A**64**, C66

Developments of advanced XAFS analysis techniques with Ifeffit

Matthew G Newville[1], Bruce Ravel[2]
[1]University of Chicago, Consortium for Advanced Radiation Sources, Building 434A, Argonne National Lab, 9700 South Cass Ave, Argonne, IL, 60439, USA, [2]National Institute of Standards and Technology, Gathersburg, MD, USA, E-mail：newville@cars.uchicago.edu

Advances in XAFS modeling and error analysis procedures that allow easier and more robust modeling of experimental XAFS data will be discussed. For example,the ability to simultaneously co-refine different XAFS data sets parameters can greatly reduce issues of uniqueness and correlations between model parameters. Using mathematical constraints and restraints to describe prior knowledge of the system and the impact this has on data refinement will be emphasized. Examples of using such a priori chemical information from bond valence sums and a priori physical information about partial pair distribution functions will be given. In addition, the impact of theoretically-derived XAFS scattering factors as from FEFF will be discussed in terms of the current limits on resolution and precision for the refinement of XAFS data.

Keywords: XAFS data analysis, XAFS, computer modelling