

# ***Electron energy-loss spectroscopy (EELS) Workshop***

**THE NEXT WORKSHOP WILL TAKE PLACE ON:** Workshop will be organised when sufficient interest is registered (Contact hours – full day workshop)

## **WHO SHOULD ATTEND THIS COURSE?**

Researchers, PhD and Hons students in the physical or biological sciences with TEM experience wishing to use EELS to investigate the composition and/or chemistry of their samples as part of their research project at the UWA Centre for Microscopy, Characterisation and Analysis (CMCA).

## **WORKSHOP OUTLINE:**

The principles and applications of electron energy-loss spectroscopy in the TEM will be reviewed through an initial lecture. Practical training on the microscope will introduce attendees to the acquisition of experimental EELS data in both image and diffraction modes. Basic spectrum analysis and interpretation will be included in the workshop. There will be opportunities for attendees to discuss the use of EELS in their research project with a member of Centre staff.

## **WHAT YOU SHOULD KNOW BEFORE THE COURSE?**

It will be assumed that attendees have a basic knowledge of the capabilities of EELS, including the main features present in an EELS spectrum and the information that can be obtained. Attendees are expected to be familiar with the basic operation of a TEM and the TEM aspects of their own research project before attending the course. You must have completed the TEM training course before you can attend the EELS workshop. It is also recommended that you gain some experience operating a TEM before attending the workshop.

## **WHAT WILL YOU LEARN ON THIS COURSE?**

Attendees will learn how to obtain and interpret EELS data, including –

- How to set up and align the microscope for EELS;
- The use of Digital Micrograph for EELS acquisition;
- How to obtain EELS spectra in imaging mode and diffraction mode;
- The various acquisition modes available in Digital Micrograph and how to optimise your data;
- The use of EELS for element identification (qualitative microanalysis);
- The use of EELS for sample thickness measurement;
- The use of EELS for valence/oxidation state and coordination determination;
- Sample requirements for EELS in the TEM (but not sample preparation methods).

## **WHAT IS NOT INCLUDED IN THIS COURSE?**

Basic information on TEM operation is covered in the TEM training course and is not included in this workshop. Detailed information on the theory of EELS spectrum formation and spectrum simulation is not included in the workshop. EELS spectrum-imaging will not be covered in this workshop (as we do not currently have the capabilities to do this).

## **TEACHING MATERIALS:**

Copies of lecture notes and supporting documentation will be made available in electronic form before the course. Attendees are expected to be familiar with the basic principles and applications of EELS in the TEM before attending the course. Many TEM-related books including EELS information can be found in the UWA library. The following are recommended –

- Electron Energy Loss Spectroscopy (2001) Rik Brydson, Royal Microscopical Society (this is an excellent introduction to EELS with practical information on how to acquire and interpret spectra).
- Electron Energy-Loss Spectroscopy in the Electron Microscope (1996) R.F. Egerton, Plenum Press (this book contains a lot of theory and details on instrumentation in addition to a lot of excellent examples of EELS applications).
- Transmission Electron Microscopy (1996), D.B. Williams and C.B. Carter, Plenum Press (one volume of the 4-volume set includes EELS)

The following journal article (and its references) will provide an overview of EELS and it is highly recommended that you download and read it before the workshop:

- R.F. Egerton and M. Malac, EELS in the TEM, JOURNAL OF ELECTRON SPECTROSCOPY AND RELATED PHENOMENA 143 (2-3): 43-50 MAY 2005.

The library also houses a set of DVD recordings of microscopy workshops run by the Microscopy Society of America.

### **RELATED TRAINING OPPORTUNITIES:**

Other TEM-related workshops currently include –

- TEM training course (for basic TEM operation);
- High resolution imaging (HREM) (for atomic resolution imaging);
- Energy-filtered TEM (EFTEM) (for element distribution imaging);
- Electron diffraction (for crystal structure analysis);
- X-ray microanalysis by TEM (for compositional analysis);
- Scanning TEM imaging (including BF and HAADF imaging);
- Sample preparation for the physical sciences (appointments can also be made with Dr Martin Saunders or Dr Alexandra Suvorova to discuss your specific requirements).

Appointments to discuss individual projects, project planning, etc. can be made directly with Centre staff (Physical Sciences – Dr Martin Saunders).

### **HOW DO I REGISTER AND WHAT DOES IT COST?**

Places on the EELS workshop are available to researchers/students with a demonstrated need to use EELS in their research.

You can register your interest in attending the next workshop by completing the online registration form.

Places are limited and preference will be given to registered CMCA Users. Your place will be confirmed in advance of the next scheduled workshop.

To find out about becoming a CMCA User contact the CMCA Manager, Jeanette Hatch.

The workshop is free to all current registered Users. All non-registered participants will be allocated a place only if maximum numbers are not reached, and a cost of \$220 (inc. GST) will apply. Any enrollee who fails to cancel their attendance more than 24h in advance will be charged a \$55 (inc. GST) no show fee.