

Sixth International Conference on X-Ray Microscopy

More than 180 participants from around the world crowded the Clark Kerr Campus of the University of California, Berkeley, from August 1-6, 1999 for the Sixth International Conference on X-Ray Microscopy (XRM99). Held every three years since 1983, the XRM conferences have become the primary international forum for the presentation and discussion of advances in high-spatial-resolution x-ray imaging and applications (including the use of x-ray spectroscopic and analytical techniques) in biological and medical sciences, environmental and soil sciences, and materials and surface sciences.

The Center for X-Ray Optics (CXRO) and the Advanced Light Source (ALS) at the Lawrence Berkeley National Laboratory (Berkeley Lab) jointly sponsored this year's meeting. As the host member of the International Program Committee, David Attwood (CXRO) chaired the meeting, while Tony Warwick (ALS) oversaw the local arrangements with the able assistance of the Berkeley Lab conference coordinator's office. The American Institute of Physics will publish the proceedings of XRM99 with Werner Meyer-Ilse (CXRO), Attwood, and Warwick as editors, who hope to have the book printed by early 2000. [Possible addition: check the XRM99 Web site at URL: <http://xrm99.lbl.gov/>.]

The International Program Committee dedicated the conference to the memory of Meyer-Ilse, who as chair of the Committee was largely responsible for the extensive program of 52 oral and 122 poster presentations but died in an automobile accident (see page xx of this issue of SRN) before he could see the fruits of his labor. At the end of the first day of the conference, there was a special session of remembrances attended by Werner's family in which events in his life were recalled, followed by the unveiling of a poster exhibit comprising photos of Werner brought by colleagues from around the world for display throughout the meeting, along with a book for attendees to sign. The poster is now installed in the ALS lobby. In addition, to honor Werner, the Committee established a memorial award to be given at each XRM conference to a young scientist (Ph.D. since the last conference or in progress) demonstrating outstanding achievement in x-ray microscopy. Normally the award will be made at the conference, but to allow time for selection, the award for XRM99 will be made in October.

Adjoining the main campus of UC Berkeley, the Clark Kerr Campus offers residential and meal services along with meeting space for conferences, features that most of those attending XRM99 took advantage of. Among other benefits, this made it possible to have leisurely, informal discussions with pre-dinner refreshments at the end of a long day of activities. The campus also hosted a Sunday evening reception in advance of the formal proceedings and the Thursday evening conference banquet, in both cases with refreshments generously sponsored by vendors of x-ray equipment (Roper Scientific, PolytecPI, and X-Ray Instrumentation Associates).

After the Sunday evening reception, the conference began its run of five mostly full days of oral and poster presentations. Following the tradition set at the first XRM in Göttingen in 1983, the organizers avoided parallel sessions by scheduling a full slate of plenary oral

presentations throughout the morning and afternoon of each day of the conference. Over the years, the content of the XRM conferences has broadened to include imaging techniques beyond soft x-ray transmission measurements based on absorption contrast. Moreover, the conferences now feature as many presentations on applications as on techniques. The titles of the oral sessions at XRM99 reflect the expanding scope of the XRM conferences: Advances in Soft X-Ray Microscopy (four sessions), Nanometer-Ray Optics (three sessions), Multi-keV Microscopy (two sessions), Biological Sciences (two sessions), Materials and Surface Sciences (two sessions), Environmental and Soil Sciences (two sessions), Novel Approaches to Coherent Imaging, Compact Sources, and Femtosecond Experiments and Holography. Posters covered the same subject areas.

With so many oral presentations, it is impossible to list every speaker and topic, but some of the main themes threading through the week's proceedings can be summarized. In the biological sciences, immunolabeling of proteins, cryocooling to enhance resistance to radiation damage, and tomographic three-dimensional imaging promise to make x-ray microscopy into a useful tool for investigating problems ranging from unraveling the mechanisms of cancer to the causes of human infertility. Environmental and soil sciences are a growing application area where it is important to be able to investigate complex, multicomponent systems in wet environments with high spectral and spatial resolution, especially with an eye toward solving waste remediation problems. In polymer science, the ability to do chemically specific imaging with sub-micrometer spatial resolution is turning into a highly fruitful use of x-ray microscopy. Magnetic materials, such as the multilayer thin films being developed for magnetic storage and memory devices, are yielding information to photoemission electron microscopes in conjunction with polarized (circular and linear) x-rays, although scanning and full-field imaging x-ray microscopes based on recording the intensity of photons transmitted through the sample are also useful.

In the area of x-ray microscopy technology, phase-contrast imaging is rapidly emerging as mainline technique for imaging objects with low absorption contrast, such as those containing only elements with low atomic numbers. X-ray microscopy at multi-keV photon energies (intermediate-energy and hard x-rays) is carving out its own application areas, including phase-contrast imaging and tomography. New electron-beam writing systems are allowing production of Fresnel zone plates for imaging with spatial resolution as low as 25 nm with higher efficiencies than ever. Methods for producing thick zone plates to enhance the efficiency for multi-keV imaging are likewise bearing fruit. In addition, novel refractive and waveguide devices are arriving that will supplement the well-established zone-plate and multi-layer-coated mirror optics. And adapting x-ray crystallographic techniques provides a possible path for imaging without optics in some cases. High-power lasers to drive compact laser-plasma x-ray sources offer a lower cost alternative to synchrotron-radiation facilities for producing high x-ray fluxes in the laboratory, although the brightness is much reduced. Looking forward to the future were reports of holographic imaging techniques and of time-resolved measurements at speeds into the sub-picosecond range.

At the end of the week, a tour of the ALS capped off the conference proceedings. More than 80 persons trooped aboard buses for the short trip up to the ALS site on the hillside above UC Berkeley, where tour guides were waiting. At the ALS, they viewed first hand the several beamlines and experimental stations dedicated to x-ray microscopy and spectromicroscopy and spoke to researchers using these facilities.

All in all, those attending XRM99 were already looking forward to XRM02, which will be held in Grenoble under the joint sponsorship of the European Synchrotron Radiation Facility (ESRF) and the Laboratoire pour l'Utilisation du Rayonnement Electromagnétique (LURE). Choice of Grenoble carries with it the anticipation that with three more years of experiments under their belts, researchers at the third-generation multi-keV synchrotron facilities, such as ESRF, will build on their already demonstrated successes and thereby join their colleagues at the soft x-ray sources as major contributors to the world of x-ray microscopy.

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Figures (use two of three?):

Figure 1. [XBC9908-01749 (group photo)]

More than 180 x-ray microscopists registered for XRM 99, the sixth in a series of tri-annual conferences that began in 1983.

Figure 2 [XBD9908-01712.15TIF]

Adam Hitchcock (McMaster University) makes a point during an XRM99 poster session.

Figure 3[XBD9908-01712.45TIF]

Ralf Graupner (Berkeley Lab) explains his poster to colleagues at XRM99.