Simultaneous Absorption and Phase Contrast Imaging using a Scanning Transmission X-ray Microscope

G R Morrison[1], A Gianoncelli[2], B Kaulich[3]

1. *Dept of Physics, King's College London, Strand, London WC2R 2LS*
2. *C2RMF - UMR CNRS 171, AGLAE, Palais du Louvre, Paris, France*
3. *ELETTRA - Sincrotrone Trieste, I-34012 Trieste-Basovizza, Italy*

The use of a segmented x-ray detector with a software-configurable response function makes it possible for the scanning transmission x-ray microscope to form images in a number of different contrast modes from a single raster scan of the specimen. In particular the use of symmetric and anti-symmetric detector responses allows both absorption and differential phase contrast images to be derived from a single scan of the specimen.

This paper describes measurements made using the Twinmic end-station at the Elettra synchrotron. This uses a Peltier-cooled, fast-readout CCD (FRCCD) detector having 128 by 128 pixels, with visible light coupling to a phosphor screen located downstream of the sample. The FRCCD records a full frame of data for every pixel in the STXM raster scan, potentially generating large volumes of data; simple real-time processing of these data yields absorption and differential phase contrast image signals, while the full volume of image data is retained to allow more sophisticated off-line analysis when required.

As the configurable FRCCD is a straightforward substitute for the more conventional single detector used in STXM, the spatial resolution of the STXM is not compromised, and is determined by the characteristics of the focusing optics, so at present, the complex specimen transmittance can be studied at a resolution of just over 0.1 μm. Measurements made at energies on either side of an x-ray absorption edge show there are considerable practical benefits to having both absorption and phase contrast information simultaneously available to the user, while through-focal series of images allow the relative importance of the real and imaginary parts of the complex refractive index to be investigated.