Hard X-ray Microscopy at the Advanced Photon Source

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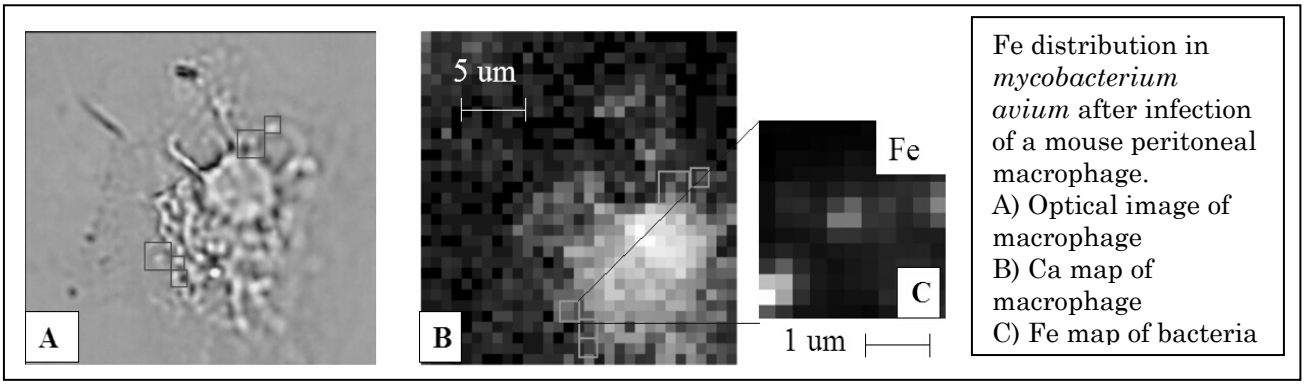
X-ray microscopy at the Advanced Photon Source has, since its beginning in 1997, developed into a powerful, versatile tool that has been implemented at various APS beamlines and is being applied to a large variety of scientific topics. Due to its high brilliance in the hard x-ray range, the Advanced Photon Source lends itself in particular to scanning probe applications that utilize x-ray fluorescence and x-ray diffraction as contrast forming mechanisms. Hard x-ray microprobes using both Fresnel zone plates and Kirckpatrick-Baez mirrors are in operation, with a spatial resolution typically in the range of 100-300 nm. With the development of x-ray optics of higher numerical aperture and concurrent improvements of the microscopy facilities, a spatial resolution of below 100 nm has been obtained more recently.

Microprobes using x-ray fluorescence are being applied in particular to biological, medical and environmental sciences, where they are used to map the distribution of trace metals in tissues, cells and bacteria.[1,2,3] Microprobes using x-ray diffraction are typically used in materials sciences, both for direct study of the crystalline structure of materials,[4] and to map strain, e.g. in systems showing ferroelectric and magnetic order.[5,6,7] An emerging application is the quest for novel materials and their applications, namely the study of nanoparticles and their interaction with their environment.[8] We will present an overview over current x-ray microscopy activities at the Advanced Photon Source, and provide an outlook for future plans. We will focus in particular or the hard x-ray nanoprobe beamline that is under construction as part of Argonne's Center for Nanoscale Materials, and aimed to provide a spatial resolution of 30 nm in the hard x-ray range.



Fe distribution in *mycobacterium avium* after infection of a mouse peritoneal macrophage.
A) Optical image of macrophage
B) Ca map of macrophage
C) Fe map of bacteria

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