Mapping Microstructure and Stress with Submicron Spatial Resolution

Bryan Valek

X-ray diffraction is a powerful analysis technique that has been used extensively to study the structural and mechanical properties of materials. Traditional x-ray diffraction techniques, however, use relatively large x-ray beams to obtain average properties from the area of interest. Miniaturization of modern devices has driven the need for x-ray diffraction data with submicron spatial resolution. X-ray microprobes that meet this resolution requirement are now routinely produced at synchrotron radiation sources.

Performing x-ray diffraction experiments at very small length scales presents a unique set of challenges. In this talk, the development of x-ray diffraction techniques with submicron spatial resolution at the Advanced Light Source will be discussed. X-ray microdiffraction is applicable to a wide range of problems in several fields, including materials and environmental sciences. This talk will focus on the mapping of local microstucture and stress in thin film materials widely used in the microelectronics industry. Several example applications will be presented, including studies of electromigration in metallic interconnect lines and local plastic deformation in thin film structures.