MAR11-2010-003883

Abstract for an Invited Paper
for the MAR11 Meeting of
the American Physical Society

Hard X-ray Microscopy with Multilayer Laue Lenses

HYON CHOL KANG, Chosun University

The possibility of imaging at near-atomic resolution using x-rays has been a dream ever since the short-wavelength nature of x-rays was demonstrated by von Laue and coworkers nearly a century ago. Even today the scientific impact of atomic-scale focusing of electromagnetic radiation would be deep and broad, because x-ray microscopy provides capabilities (ability to penetrate, sensitive and accurate elemental and structural information) that are complementary to other high-resolution microscopies. Although hard x-rays can in principle be focused to spot sizes on the order of their wavelength (0.1 nm), this limit has never been approached because of the difficulty in fabricating the optics. Multilayer Laue lens(MLL) is a novel diffractive optic for hard x-ray nano-focusing, which can be fabricated by sputter deposition of zone plate structure on flat substrate. According to the theoretical results, MLL is capable of focusing x-rays to well below 1 nm. We have demonstrated 2-dimensional focusing of hard x-rays with MLLs to a spot size of 25 nm x 27 nm with an efficiency of 2% at a photon energy of 12 keV, while 1-dimensional focus of 16 nm has been achieved. In this talk, we will present an overview of MLL microscopy and recent accomplishments for the determination of chemical composition in nanoscale systems. Lastly, we will give the capabilities of MLL microscopy that have the potential to significantly advance materials science, nanoscience, bio-medical science and environmental science.