Abstract for Invited Talk at the
2003 Fall Meeting of The Minerals, Metals & Materials Society (TMS)
Symposium: Frontiers of X-Ray and Nanobeam Diffraction
November 9-12, 2003, Chicago, IL

Polychromatic x-ray microdiffraction studies of the evolution of grain microstructures in 2D and 3D materials

J. D. Budai, W. Yang, B. C. Larson, J. Z. Tischler, W. Liu, and G. E. Ice, *Oak Ridge National Laboratory*

We have used submicron-resolution x-ray microscopy to investigate the formation and dynamics of grain microstructures for thin-film (2D) and bulk polycrystalline (3D) materials. Measurements were made using focussed polychromatic x-rays, a CCD area detector and automated analysis of Laue patterns. Illustrating these techniques for 2D thin films, we present orientation and strain maps describing the heteroepitaxial growth of oxide films on textured nickel substrates for superconducting applications. Here, we have discovered systematic crystallographic tilts of oxide grains relative to the underlying metal grains. Tilt mechanisms and the resulting texture and transport enhancements are discussed. Illustrating microdiffraction from 3D bulk materials, we have initiated studies of thermal grain growth in aluminum polycrystals. Complete 3D grain boundary maps reveal motion of both high-angle and low-angle boundaries after annealing above 300˚C.

Work on UNICAT beamline at APS sponsored by U.S. DOE contract DE-AC05-00OR22725 with UT-Battelle, LLC