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MICROBEAM X-RAY DIFFRACTION FOR 3D INVESTIGATION OF PLASTIC STRAIN AND DEFORMATION IN THIN-FILMS AND SUBSTRATES*

B. C. Larson, W. Yang, G. E. Ice, J. Z. Tischler, and J. D. Budai
Oak Ridge National Laboratory, P.O. Box 2008, Oak Ridge, TN

W. P. Lowe
Howard University, Washington D.C.

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B. C. Larson, W. Yang, G. E. Ice, J. Z. Tischler, and J. D. Budai, Oak Ridge National Laboratory, Oak Ridge, TN, and W. L. Lowe, Howard University, Washington, D.C.

We have developed a new and general x-ray microbeam technique for submicron resolution 3D investigation of structure, orientation, elastic strain, and plastic deformation in thin-films, substrates, and bulk materials. The technique utilizes polychromatic (white) x-ray microbeams, differential-aperture diffracted beam depth profiling, and computer automated analysis of the crystallographic orientation and stress/strain in sub-micron resolution 3D voxels in single-crystals, polycrystals, heterostructures, and deformed materials. The basic features of the technique will be described and the results of applications to measurements of 3D elastic and plastic strain distributions will be discussed. The potential for direct comparison of results of such measurements with detailed computer simulations and modeling of deformation microstructure in thin-films, substrates, and bulk materials will be considered.

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