A24

Toward the development of high resolution synchrotron x-ray diffraction tomography of polycrystalline materials

Stuart R. Stock, D. P. Piotrowski, A. Guvenilir, C. R. Patterson, and J. D. Haase
School of Materials Sci. & Eng., Georgia Institute of Technology, Atlanta, GA 30332-0245, USA

Zofia U. Rek
SSRL, P.O. Box 4349, Bin 69, Stanford, CA 94309-0210, USA

In understanding the macroscopic response of polycrystalline structural materials to loading, it is frequently essential to know both the three-dimensional distribution of strain and of micro-texture. The methods must be nondestructive, however, if the evolution of quantities such as strain at a fatigue crack tip are to be studied. This paper describes approaches for high resolution synchrotron x-ray diffraction tomography of polycrystalline materials. Preliminary experiments are reported on partially cracked compact tension samples of Al-Li 2090 and on model samples of randomly-packed, millimeter-sized single crystals. Polychromatic beams collimated to diameters as small as 30 μm have been used, and collecting the spatial distribution of diffracted intensity on image storage plates as a function of sample to detector separation allowed inference of the depth of the volume elements contributing to diffraction. The precision to which one can determine the depths of volume elements will be discussed as well approaches for three-dimensional, nondestructive strain mapping.