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THREE DIMENSIONAL (3D) MICROSTRUCTURE VISUALIZATION AND MODELING OF DEFORMATION IN METAL MATRIX COMPOSITES BY IN SITU X-RAY SYNCHROTRON TOMOGRAPHY

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Abstract

Characterization of damage often involves laborious cross-sectioning, characterization, etc. X-ray tomography provides a wonderful means of characterization damage non-destructively. We report on a novel methodology that addresses the critical link between microstructure and deformation behavior, using x-ray synchrotron tomography. The approach consists of in situ tensile testing in an x-ray synchrotron, followed by x-ray tomography and image analysis, and 3D reconstruction of the microstructure. Incorporation of the microstructure into a finite element modeling code for simulation can also be conducted. We present a case study based on uniaxial tensile deformation of SiC particle reinforced Al alloy matrix composites. In particular, the evolution of damage in the form of particle fracture, interfacial debonding, and void growth will be described. Use of the Advanced Photon Source was supported by the U.S. Department of Energy, Office of Science, Office of Basic Energy Sciences, under Contract No. DE-AC02-06CH11357.

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