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Submitted to the Materials Science & Technology 2003 Meeting, Chicago, Illinois, November 9-12, 2003

X-Ray Structural Microscopy Investigation of Creep Deformed Ti-6wt%Al Polycrystals

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CONDENSED MATTER SCIENCES DIVISION
OAK RIDGE NATIONAL LABORATORY
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UT-BATTELLE, LLC.
under
Contract No. DE-AC-05-00OR22725
with the
U.S. DEPARTMENT OF ENERGY
Oak Ridge, Tennessee

April 2003

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Titanium alloys with large alpha-phase volume fractions tend to creep significantly, even at room temperature. Time-dependent load-shedding from soft- to hard-oriented HCP grains is the potential source of this unusual characteristic. Differential-aperture x-ray microscopy (DAXM) measurements have been initiated to study the deformation substructure in polycrystalline Ti-6wt%Al samples crept to several strain levels. Micron resolution inter- and intra-granular measurements of local crystallographic orientations and strain are used to obtain spatially resolved dislocation tensor measurements and geometrically necessary dislocation (GND) distributions. The measurements were made on the UNI-CAT microbeam diffraction beamline at the Advanced Photon Source. The polychromatic x-ray microbeam diffraction technique will be described and dislocation tensor, local strain tensor, and GND measurements will be presented. Research sponsored in part by DOE Office of Science Division of Materials Research through ORNL managed by UT-Battelle LLC, and by AFOSR Grant F496200-02-1-0013 at the Ohio State University; APS supported by DOE.