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Dislocation patterning in the deformed Ni- bicrystal from polychromatic microdiffraction G. E. ICE, R.I. BARABASH, J.W.L. PANG, Oak Ridge National Laboratory, Oak Ridge TN 37831, USA — After plastic deformation geometrically necessary (polar) dislocations as well as geometrically necessary boundaries form in a crystal. The polar dislocations density is related to the incompatibility of the plastic deformation and to the local lattice curvature. Polar dislocations spread the conditions for x-ray (or neutron) diffraction transverse to the reciprocal space vector of each reflection. Polychromatic X-ray microdiffraction (PXM) is sensitive to the density and organization of the dislocations, which occurs at several structural levels. Diffracted intensity depends on the Nye dislocation tensor. Laue patterns are sensitive to the ratio between geometrically necessary and statistically stored dislocations density. Different slip systems of polar dislocations population cause distinctly different streaking in Laue patterns. The co-evolution of the statistically stored (dipolar) and geometrically necessary dislocations (polar) may be analyzed, and the ratio between the two densities may be obtained from the analysis of the Laue spots intensity distribution. The microbeam technique is applied to analyze a dislocation structure in a Ni bicrystal under in-situ uniaxial pulling. Formation of polar and dipolar dislocations arrangements together with lattice rotations were observed during in situ uniaxial pulling of a Ni bicrystal. Lattice rotations and dislocation density depends on the distance from the boundary and on the orientation of the grain relative to the tensile axis.

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