

Evolution of uranium dislocation structure at different-rate deformation and different-temperature annealing

A.E. Shestakov and I.V. Artamonov

Russian Federal Nuclear Center – Zababakhin All-Russia Research Institute of Technical Physics, Snezhinsk, Russia

Abstract. The Williamson-Hall method based on analyzing the angular dependence of diffraction maximum broadening is used to study the dislocation structure. Densities of chaotically arranged dislocations on samples after their different-rate deformation are measured. Consideration is given to the dislocation structure of a spherical uranium sample after its shock-wave loading, as well as to the dislocation structure of model samples deformed at the rate of $\sim 10^{-3}\text{s}^{-1}$ up to 5%, 20%, and 60% relative deformation. After deformation, samples were vacuum annealed at 200C, 400C, 600C, 720C, and 850C (in alpha-, beta-, and gamma-phases). Samples were cooled at the rate of $\sim 10^\circ/\text{min}$. Results for samples subjected to different-rate deformation and different-temperature annealing are compared. In the dislocation structure of the sample recovered after shock-wave loading, special features that cannot be described with the help of mechanisms observed at the low-rate deformation and cooling were elucidated. Systematic investigations of the uranium dislocation structure at the increasing speed of loading are to be continued).