REVEALING THE MICROSTRUCTURAL PROCESSES CONTROLLING DEFORMATION AND FRACTURE

I. M. Robertson

Department of Materials Science and Engineering
University of Illinois
ianr@uiuc.edu

Straining experiments performed in a transmission electron microscope reveal the deformation and fracture processes controlling the mechanical properties of materials. Knowledge of the basic deformation processes can be used to formulate and validate a mesoscale model to predict material behavior. Two examples will be presented. The first concerns with the effect of grain size yield strength of polycrystalline Ag. Macroscopically, the yield strength is greater in the finer than in the coarser grained material. The in situ straining technique is being used to identify the microplastic processes that operate prior to long-range plastic flow that can account for this difference. The second example will consider the interaction between dislocations and obstacles, the annihilation of these obstacles and the creation of obstacle-free channels. In both cases the input from the in situ experiments will be used to develop mesoscale models.