Predictive microstructural evolution via localized strain dependence measurements using correlated precession diffraction and In situ TEM

Taheri, Mitra, mtaheri@coe.drexel.edu, Drexel University

ABSTRACT

Although significant advances have been made in elucidating atomic-scale mechanisms that control properties of polycrystalline materials for a wide range of applications, the need for predictive understanding of material response based on crystal orientation information still exists. In this discussion, a combined approach to understanding strain-driven microstructural evolution processes using in situ transmission electron microscopy (TEM) and precession diffraction is described. Specifically, TEM-based Nanomegas DIGISTAR/ASTAR orientation mapping and precession diffraction techniques in conjunction with in situ TEM heating, strain, and irradiation will be discussed. Case studies of the advantages and drawbacks of TEM-based orientation imaging and precession diffraction during in situ TEM exploration of the stability of irradiated nanocrystalline BCC metals and strain-based twin evolution in FCC metals will be highlighted, and compared to SEM-based EBSD strain measurement techniques. The results presented will help provide a connection of the role of localized strain in developing stable materials for extreme applications.