

THE SECRET LIVES OF TWINS

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Focus Material: Metals

Focus of the Presentation:

(i) Multi-scale data acquisition, characterization and experiments at different scales

Abstract

Deformation twinning is an important deformation mechanism in a variety of materials, including metals and ceramics. This mechanism is particularly important in HCP metals and in BCC metals at high rates of deformation. We focus here on the dynamics of twinning through fundamental experiments and simple modeling, examining twinning in magnesium (Mg). Extension twins in Mg can accommodate significant plastic deformation as they grow, and thus twinning affects the overall rate of plastic deformation. We perform impact and high-strain-rate experiments on single crystals of Mg, and use high-speed imaging at 5 million frames per second to capture in situ the development of twinning modes. The velocities of the twins are thus obtained through direct real-time observations. Electron back-scattered diffraction is then used to characterize the nature of the twins and the microstructural evolution. Through these approaches we describe the dynamics of twinning and then seek to clarify the associated kinetics.