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Structure and Dynamics with Ultrafast Electron Microscopes: Watching nano-microstructural evolution during complex crystallization in a-Ge

Tuesday 14 June 2016 19:00 (2 minutes)

The crystallization of amorphous semiconductors is a strongly exothermic process. Once initiated, the release of latent heat can be sufficient to drive a self-sustaining crystallization front through the material in a manner that has been described as explosive. Using Dynamic Transmission Electron Microscope (DTEM), we have obtained time-resolved snap shots of three distinct microstructural zones as they are formed following pulsed laser excitation. This allows the direct observation of a rich variety of physical processes occurring at nanosecond time scales, including nanocrystallite nucelation and grain growth, crystallization front faceting and self-diffusion at the interface as well as the onset of complex layered microstructure far from initially illuminated zone. This work reveals new insights into the mechanisms governing this complex crystallization process and provides a dramatic demonstration of the power of DETM for studying time-dependent material processes far from equilibrium.

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