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Defect Structure Information Possible from Sub-Picosecond Bragg Diffuse Scattering Measurements of Displacement Cascade Dynamics B.C. LARSON, J.Z. TISCHLER, R.E. STOLLER, Oak Ridge National Laboratory — The ∼100 femtosecond hard x-ray pulses from the Linac Coherent Light Source (LCLS) provide for the first time the capability of time-resolved measurements of the defect structural dynamics associated with energetic (i.e. tens of keV) atomic displacement cascades in crystalline materials. The local Bragg scattering origin of so-called "asymptotic" diffuse scattering near Bragg reflections provides a basis for performing detailed investigations of the structural evolution associated with cascades through the analysis of sub-picosecond time-slice diffraction measurements made at varying times during and after the initiation of cascades by energetic ions. The results of asymptotic diffuse scattering calculations performed using molecular dynamics displacement cascade simulations, for varying times during the generation of cascades and during the cascade annealing process will be presented. The correspondence of the calculated diffuse scattering patterns with the defect structures present in the molecular dynamics simulations will be discussed in terms of the information that could be obtained from 100 femtosecond time-resolved measurements of cascade dynamics using the LCLS.

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