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Investigation of the kinetics and microscopic mechanism of solid-solid phase transitions in HMX PAMELA BOWLAN, NATALYA SUVOROVA, DAVE OSCHWALD, JOHN BOWLAN, KIRK RECTOR, BRYAN HENSON, LAURA SMILOWITZ, Los Alamos National Lab — Although studied intensely in the 2000's, a number of important questions about solid-solid phase transitions in the energetic organic material octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX) remain. The mechanism by which one of the four isomorphs, known as δ, γ, α and β, transforms into another, and the conditions (i.e. temperature and pressure) and rates at which these transitions take place are still not fully known, yet important for predicting and controlling energy release phenomena in HMX such as detonation. The theory of virtual melting, by which a liquid forms at the interface of a nucleation site, is necessary to explain transformations between certain of the four different phases of HMX, such as the $\beta$to δ transition. However the existence of this disordered intermediate state has never been directly proven due to the need for both spatial (<m), temporal (the lifetime of the transient melt state is unknown) and structural information. Also, while the β to δ transition was more thoroughly studied, less is known about the other 10 possible phase transitions. We will report on our study of phase transitions in HMX using X-ray diffraction and confocal Raman and near-field infrared microscopy.

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