Abstract Submitted for the SHOCK19 Meeting of The American Physical Society

The Role of Adhesion and Young's Modulus in Hot-Spot Formation in Energetic Materials Due to Ultrasonic and Impact Excitation¹ JASON WICKHAM, ZANE ROBERTS, STEPHEN BEAUDOIN, STEVEN SON, Purdue University — In order to examine the possible mechanisms of heat generation ("hot-spot" formation) for ultrasonic excitation, a mechanically-delaminated inclusion of HMX in polymer binder was subjected to ultrasonic excitation utilizing an ultrasonic transducer. The Young's modulus and surface energy of the polymer binders were varied in order to determine if a relationship existed between these properties and the heating rate. Drop weight impact tests were also performed with samples containing 85% HMX by weight to investigate if these material properties had similar effects on the sensitivity of the composition. Experimental results suggest that the work of adhesion has no effect on the heating rate at the inclusion, but a positive correlation exists between the Young's modulus of the polymer material and the heating rate at the inclusion. Drop weight experiments demonstrated a strong negative trend between the modulus and the drop height, but no such relationship was observed with the work of adhesion. These results suggest that the stiffness of the material plays an important role in the energy dissipation mechanisms responsible for hot spot formation in these materials and that compliant materials exhibit a lesser degree of sensitivity.

¹Air Force Office of Scientific Research

Jason Wickham Purdue University

Date submitted: 28 Feb 2019

Electronic form version 1.4