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The Anisotropic Dynamic Response of Ultrafast Shocked Single Crystal PETN and Beta-HMX[1] JOSEPH ZAUG, MICHAEL ARMSTRONG, JONATHAN CROWHURST, RYAN AUSTIN, LOUIS FERRANTI, LAURENCE FRIED, SORIN BASTEA, Lawrence Livermore National Laboratory — We report results from ultrafast shockwave experiments conducted on single crystal high explosives. Experimental results consist of 12 picosecond time-resolved dynamic response wave profile data, (ultrafast time-domain interferometry -TDI), which are used to validate calculations of anisotropic stress-strain behavior of shocked loaded energetic materials. In addition, here we present unreacted equations of state data from PETN and beta-HMX up to higher pressures than previously reported, which are used to extend the predictive confidence of hydrodynamic simulations. Our previous results derived from a 360 ps drive duration yielded anisotropic elastic wave response in single crystal beta-HMX ((110) and (010) impact planes). Here we provide results using a 3x longer drive duration to probe the plastic response regime of these materials. We compare our ultrafast time domain interferometry (TDI) results with previous gun platform results. Ultrafast time scale resolution TDI measurements further guide the development of continuum models aimed to study pore collapse and energy localization in shock-compressed crystals of beta-HMX.

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