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Microstructural effects on ignition sensitivity in Ni/Al systems subjected to high strain rate impacts ROBERT REEVES, Purdue University, ALEXANDER MUKASYAN, University of Notre Dame, STEVEN SON, Purdue University — The effect of microstructural refinement on the sensitivity of the Ni/Al (1:1 at%) system to ignition via high strain rate impacts is investigated. The tested microstructures include compacts of irregularly convoluted lamellar structures with nanometric features created through high-energy ball milling (HEBM) of micron size Ni/Al powders and compacts of nanometric Ni and Al powders. The test materials were subjected to high strain rate impacts through Asay shear experiments powered by a light gas gun. Muzzle velocities up to 1.1 km/s were used. It was found that the nanometric powder exhibited a greater sensitivity to ignition via impact than the HEBM material, despite greater thermal sensitivity of the HEBM. A previously unseen fast reaction mode where the reaction front traveled at the speed of the input stress wave was also observed in the nanometric mixtures at high muzzle energies. This fast mode is considered to be a mechanically induced thermal explosion mode dependent on the magnitude of the traveling stress wave, rather than a self-propagating detonation, since its propagation rate decreases rapidly across the sample. A similar mode is not exhibited by HEBM samples, although local, non-propagating reaction zones occur in shear bands formed during the impact event.

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