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Impact-induced initiation and energy release behavior of pre-stressed aluminum reactive materials[1] KEVIN HILL, DYLAN SMITH, MICHELLE PANTOYA, Texas Tech University, MICHELLE L PANTOYA TEAM — One approach to improving aluminum (Al) particle reactivity is to anneal and quench particles in order to increase dilatational (volumetric) strain which has also been linked to increased combustion performance. This study compares the reactivity of pre-stressed to as-received Al particles, when each is combined with a solid oxidizer, copper oxide (CuO). Reactivity was examined under dynamic testing techniques for ignition and energy release characteristics. Experiments utilized a drop weight impact apparatus that provided up to 50 J impact energy and included a pressure cell that contained the Al + CuO composite. The cell was instrumented with PCB 101A06 dynamic pressure sensors and measured the pressurization rate and peak pressure from ignited samples. Using fundamental relationships between maximum pressure and the energy deposited into the material, a reaction efficiency is derived. Results show a significant increase in ignition sensitivity and reaction efficiency for the annealed and quenched aluminum particles. Changes in physiomechanical properties of Al particles upon pre-stressing affect particle hardness. These changes lead to significant enhancements in ignition sensitivity, with differences of more than 10 J between pre-stressed and untreated samples.

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