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Enhanced reactivity of mechanically-activated nano-scale gasless reactive materials consolidated via the cold-spray technique ANTOINE BACCIOCHINI, MATEI RADULESCU, ONUR MEYDANOGLU, YANNICK CHARRON-TOUSIGNANT, JASON VAN DYKE, BERTRAND JODOIN, MICHEL NGANBE, MOHAMED YANDOUZI, University of Ottawa, JULIAN J. LEE, DRDC-Suffield — It has been speculated that gasless reactive systems can sustain supersonic detonations waves, provided the local decomposition rate is sufficiently fast and the initial density is sufficiently close to the theoretical maximal density. The present study presents a novel method to prepare nano-scale energetic materials with high reactivity, vanishing porosity, structural integrity and arbitrary shape. The experiments have focused on the Ni-Al system. To increase the reactivity, an initial mechanical activation was achieved by the technique of ball milling. The consolidation of the materials used the supersonic cold gas spray technique, where the particles are accelerated to high speeds and consolidated via plastic deformation upon impact, forming activated nano-composites in arbitrary shapes with close to zero porosity. This technique permits to retain the micro-structures in the powders and prevents any reactions during the consolidation phase. Deflagration tests of the obtained samples showed an increase in the deflagration rate by up to two orders of magnitude.

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