Public Abstract

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Title:ELECTROPHORETIC DEPOSITION OF GRAPHENE ENHANCED ALUMINUM AND BISMUTH TRIOXIDE NANOTHERMITE THIN FILMS

The work described herein details the characterization of aluminum and bismuth trioxide nanothermite thin films formed by electrophoretic deposition. Additionally, graphene was added to nanothermites before deposition to enhance the thermal conductivity of deposited thin films, to create denser thin films via directed self-assembly, and to increase the energetic content of the composite. Electrophoretic deposition was selected as the deposition method for this work due to its strong synergy with MEMS processing methodologies, its scalability, and its tunable deposition parameters, which allows for a high degree of control over the resulting nanothermite thin film combustion behavior.

The deposited nanothermite thin films were characterized with respect to mass, thickness, density, homogeneity, and combustion velocity. Precursor nanothermite suspensions that contained graphene yielded thin film structures with more mass, larger thicknesses, and faster combustion velocities. The augmentation of these parameters is believed to be attributed to the self-assembly of aluminum and bismuth oxide with graphene, which results in densified nanothermite structures that benefit from increased interfacial particle contact between fuel and oxidizer particles, as well as reduced mass diffusion lengths. Additionally, the high thermal conductivity of graphene allows heat generated by the nanothermite reaction to remain within the deposited thin film, which contributes to increasing the combustion velocity and total energetic output of the nanothermite reaction.