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Development of Metal Cluster-Based Energetic Materials JAMES LIGHTSTONE, JOSEPH HOOPER, CHAD STOLTZ, BECCA WILSON, NSWC-IHD, DENNIS MAYO, BRYAN EICHHORN, University of Maryland, KIT BOWEN, Johns Hopkins — The energy available from the combustion of Al is 2 to 3 times that of conventional high explosives and as a result is often loaded into explosive and propellant formulations in micron and nano-particle form. However, even at the nano-scale the release of energy is slowed by the reaction kinetics of particle oxidation. In order to realize faster reaction rates, on the order of current CHNO explosives, the size of the particles of interest need to be reduced significantly into the molecular size-range (10's of atoms). Current research efforts at NSWC-IHD are utilizing gas-phase molecular beam studies, theoretical calculations, and condensed-phase production methods to identify novel metal cluster systems in which passivated metal clusters make up the subunit of a molecular metal-based energetic material. To date, small amounts of a metal-based compound with a subunit containing four Al atoms and four Cp* ligands has been produced and is currently being characterized using DSC and TGA. Additional Al based systems passivated with a variety of organic ligands are being systematically examined. Analytical and theoretical results obtained for $Al_4Cp^*_4$ and the additional cluster systems under investigation along with their potential energetic applications will be presented.

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