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IMN-KOLLOQUIUM

Donnerstag, 29. Juni 2023 um 13:00 Uhr im Feynmanbau Raum 114/115

Prof. Timothy P. Weihs
Department of Materials Science and Engineering,
Johns Hopkins University, Baltimore

Optimizing the Chemistry of Metal Powders for Ignition and Combustion

Elemental Al or Mg powders are commonly used in high explosives, propellants, and pyrotechnics to enhance performance, yet in many cases combustion efficiencies are well below 100%. Recent closed-chamber detonation studies suggest that multi-element or alloyed metal powders ignite more readily and reach much higher combustion efficiencies than elemental Al powders. However, our community is just beginning to explore the many alloys that can be formed by mixing elements with high heats of combustion such as Al, Mg, Li, B, Si, Ti, and Zr. Given small variations in the atomic fraction of four elements in an alloyed powder generate over a million potential chemistries, we are leveraging a combinatorial process to rapidly screen the ignition and combustion properties of alloyed metal powders. We do so by sputter depositing ~ 30 micron thick coatings onto polymer meshes and then debonding the coatings to create elongated powders. In our first two combinatorial studies 1) we systematically vary the at% of Zr in Al-Zr and Al-Mg-Zr powders and 2) we vary the relative percentage of Al and B in Al-B-Ti powders. In this presentation we report on trends in ignition temperatures as a function of chemistry using hot wire experiments, and we describe their combustion temperatures, durations, and gaseous species using a novel, hyperspectral imaging system. Trends in the measured properties as a function of chemistry will be compared with those for elemental powders.

Vortragssprache: englisch