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Tuesday, October 24, 2023
11:00 AM – 12:00 PM (ET) | Zoom

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Additive Manufacturing of Energetics: from propellants to initiator inks

ABSTRACT

Additive manufacturing (AM) is a growing field of research, offering advantages in accuracy, logistics, and design that are difficult or impossible through conventional manufacturing. Adaptation of AM techniques for energetic materials, whether it is munition propellant, rocket propellants, or high explosives, has lagged behind most other materials in being adapted to AM methods. In this talk, results from two AM projects related to energetic materials in Dr. Hargather's research lab are given. First, seven propellant formulations designed for additive manufacture in a custom-built extrusion-driven platform are characterized in terms of apparent initial viscosity, time-dependent viscosity changes, and combustion properties, as well as the tensile properties of the final product relative to a cast material. Both spindle and extrusion-based viscometry methods are employed and compared. The formulations that behave similarly to a Bingham plastic are determined to be most suitable for printing applications. Second, ongoing work on the development and characterization of a pyrotechnic initiator ink is presented. The goal of the initiator ink is to demonstrate multi-point initiation on an energetic substrate. Formulation development and initial characterization of the viscosity and burn rates of thermites blended with iron sulfide in an energetic binder are discussed.

BIOGRAPHY

Dr. Chelsey Hargather is an Associate Professor of Materials & Metallurgical Engineering and runs the Advanced Computational Metallurgy Lab/Additive Composite Manufacturing Lab (ACML2) at New Mexico Tech. Dr. Hargather's research group has two research areas. In computational materials science, the group focuses on using atomistic simulations and phase diagrams to understand the behavior of specific alloying elements in or improve the performance of metallic engineering alloys. Her second research area involves formulation development of solid composite rocket propellant and energetic initiator inks suitable for additive manufacturing applications. Dr. Hargather's current research projects are funded by National Science Foundation (CAREER), Army Research Lab, and DOE NNSA. Dr. Hargather received a PhD in Materials Science and Engineering from The Pennsylvania State University in 2012. She received a BS in Materials Science and Engineering with a minor in French from Virginia Polytechnic Institute and State University in 2008.



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