SEMTE seminar

Combustion Characterization of Advanced Composite Energetic Materials

School for Engineering of Matter, Transport and Energy

abstract

Composite energetic materials are a mixture of solid fuel and oxidizer that contain high energy density and have the potential to release significant chemical energy upon combustion. This class of energetic materials enables tailoring reactants toward specific applications, unlike explosives whose reactivity is kinetically limited by the monomolecular crystal structure. This presentation will highlight interesting current research addressing important issues regarding the combustion of energetic composite materials. Combustion characterization includes evaluation of reaction temperatures such that a new diagnostic approach for thermally mapping the temperature distribution surrounding a composite energetic material reaction will be presented. Another pressing issue is the limited field use of nano-particles that are plagued with environmental and safety issues, yet exhibit enhanced reactivity unprecedented in their micron scale counterparts. Towards this end, we have been synthesizing micron-scale particles that reactively behave like nano-particles without the nano-scale limitations. This is being achieved by manipulating the core-shell structure of aluminum particles to activate a reaction mechanism that has been identified for nano-scale particles. For aluminum particles, halogen based oxidizers have recently shown exothermic reaction with the passivation shell that enhances the overall reactivity of the composite. This unique surface chemistry can be exploited to engineer new super-reactive composites and will also be discussed. Ignition is another aspect of combustion characterization, and recent studies have revealed new insights into the electrostatic ignition sensitivity of these composites that will improve our safe handling and use of these powders. All of these studies collectively introduce a whole new class of materials for diverse energy generation applications ranging from powering MEMS technologies to providing cleaner lead-free ordnance systems.

Dr. Michelle Pantoya

Department of Mechanical Engineering
Texas Tech University

biosketch

Dr. Michelle Pantoya received her PhD from the University of California, Davis in 1999 and joined the faculty in the Mechanical Engineering Department at Texas Tech University in 2000. As a Professor, her research focuses on developing nano-fuel particles that can be used to enhance our national safety and security. She has received many research awards including the US Presidential Early Career Award (PECASE) and the Department of Defense Young Investigator Program Award. Michelle has also co-authored two children's books introducing engineering to young kids that have received national awards and recognition and actively works to promote engineering education in the early years.

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