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Advanced and Nanoscale Energetic Materials

2 days -1 instructor

OVERALL OBJECTIVES:

The overall objective is to learn the unique aspects of advanced and nanoscale energetic material and their combustion behavior, and to develop the fundamental knowledge and skills involved that can be applied in future materials development regardless of specific application. This course is for those involved with the propellant, explosives, or pyrotechnics applications. It is aimed at those who are working in R&D of novel energetic materials.

Specific objectives are:

1. To be introduced to advanced and nanoscale energetic materials issues.
2. To review relevant thermodynamics, flame structure, chemistry, etc.
3. To be introduced to advanced materials and applications including high nitrogen materials, experimental and modeling challenges, technical gaps and issues, micropropulsion, combustion synthesis, green energetics, etc.
4. To provide the foundation of nanoscale energetic composites including their fabrication, formulation, unique challenges (aging, sensitivity, etc.), characterization, propagation physics, experimental techniques (ignition and combustion), state of modeling, combustion synthesis, green energetics, research gaps and issues, etc.

LEARNING OBJECTIVES:

At course completion student should be able to apply principles to material development, ignition, deflagration, flame spreading, convective combustion, propagation physics, experimental methods, modeling approaches, ignition, deflagration, metal combustion, thermites, intermetalics, experimental methods, and modeling approaches applicable to advanced and nanoscale EMs.

Expectations of a student will depend on his/her degree level and professional position.

IMMEDIATE BENEFITS:

Each student who completes this course will gain an immediate set of peers who have had the same experience. He will also know several people who are involved daily with advanced and nanoscale energetic materials, whom he/she can call, as required.

INSTRUCTOR:

Prof. Steven F. Son (Citizenship: USA; Active DOE Q Clearance) is Associate Professor of Mechanical Engineering at Purdue University at West Lafayette, Indiana. He received his Ph.D. in Mechanical Engineering from the University of Illinois in 1993, after which he was a J. Robert Oppenheimer Fellow at Los Alamos National Laboratory. In 1996 he became a Technical Staff Member at Los Alamos and then a Project Leader. In 2005 he was a visiting scientist at Penn State University, and in 2006 he accepted a tenured faculty position at Purdue University. He has edited a special journal section, co-authored a book chapter, and published more than 100 technical research papers. He is currently a Member of the Combustion Institute, AIAA, and ASME. He has been a paper and grant referee for many organizations and journals, and is currently an Associate Editor for the AIAA Journal of Propulsion and Power. His expertise is in the area of multiphase combustion with an emphasis on propellant combustion, nanoscale energetic materials, heterogeneous combustion, reactive materials, combustion synthesis, and explosives safety.