IOWA STATE UNIVERSITY

Center for Multiphase Flow Research and Education

Ignition and Combustion of Shock-Dispersed Reactive Powder

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Abstract

Explosions in coal mines, food processing facilities, metal working factories, and even everyday life occur with alarming regularity. Despite a long history of research and its importance to safety and defense applications, the physical mechanisms that govern the ignition and combustion of reactive dust remain relatively unknown. Basic questions such as "What are the physical mechanisms that lead to self-propagating dust explosions?", "What are the ignition and combustion mechanisms of explosively-dispersed reactive powder?" remain unanswered. This presentation will discuss an ongoing numerical simulation effort aimed at answering these and other fundamental questions. This problem is addressed by solving a set of equations that couples a fully compressible gas to a kinetic-theory model for a granular medium that account for compaction effects and particle-particle interactions. The results of these simulations indicate that shock propagation, granular mechanics, dust dispersal, ignition, and combustion of the particles are tightly coupled in a highly dynamic process. Results discussing the ignition and combustion mechanisms of reactive aluminum particles dispersed by a TNT-charge will be discussed. The presentation will close by discussing recent work that is exploring the role of thermal radiation on the initiation and propagation of dust explosions.

Biography

Dr. Houim received a B.S degree in Mechanical Engineering from North Dakota State University in 2004 and a Ph.D. degree in Mechanical Engineering from the Pennsylvania State University in 2011. He was awarded a National Research Council Post-Doctoral Fellowship at the Naval Research Laboratory in 2012. Dr. Houim is currently an Assistant Professor at the University of Florida. He is the recipient of NSF CAREER and AFOSR YIP awards. His research has focused on a wide range of topics in multiphase flow, combustion, and numerical simulation including model and numerical algorithm development, deflagration-to-detonation transition, dust explosions, propulsion, internal ballistics of gun systems, and metal particle combustion.

Refreshments will be provided.

This seminar counts towards the ME 600 seminar requirement for Mechanical Engineering graduate students.

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