Dynamic Materials and Interactions

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Martin J. Schmidt, Ph.D.
Program Officer
Air Force Office of Scientific Research

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Dynamic Materials and Interactions Motivation

Internal Carriage / Payload Constraints	→	High energy density; Multifunctional (energetic/reactive/structural) materials; Insensitive
Survivable Systems	→	Mechanics of heterogeneous materials; Survivable energetics; Combined thermal and acoustic loading; Thermally stable materials
Rapid Development Time	→	Energetic materials by design; Predictive multi-scale modeling and simulation

Dynamic Materials and Interactions Overview

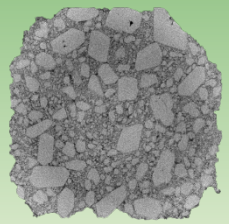
Program Objectives:

Conduct fundamental, basic research into the **dynamic** chemistry and physics of **complex materials**, particularly Energetic Materials (EMs).

Research Areas:

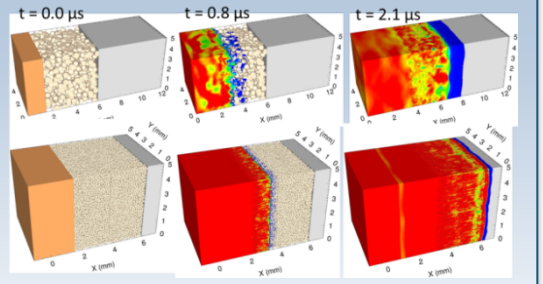
Energetic Materials Science

- Predictive processing-structure-property relationships



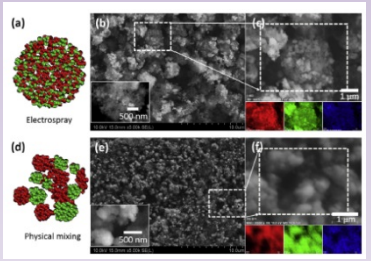
Dynamics of Heterogeneous Mat'ls

- Material structure – shock wave interactions
- Stress wave tailoring



Reactive Materials

- Enhanced energy content and improved efficiency
- New energetic mat'ls



Basic Research Challenges / Program Concerns

- **Lack of predictive understanding requires long development times and large resource investment for new explosive formulations**
- **Dynamic response of heterogeneous materials is complex and continuum response depends on the stochastic mesostructure**
  - **How do you bridge the multiple length and time scales involved**
  - **How do you account for material heterogeneity at the continuum**
- **Mesoscale validation experiments are extremely challenging but critical to code validation and model development**
- **How to realize the promise of increased energy density from Reactive Materials**