Dynamic Materials and Interactions

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Dynamic Materials and Interactions

Motivation

Internal Carriage / Payload Constraints

Survivable Systems

Rapid Development Time

High energy density; Multifunctional (energetic/reactive/structural) materials; Insensitive

Mechanics of heterogeneous materials; Survivable energetics; Combined thermal and acoustic loading; Thermally stable materials

Energetic materials by design; Predictive multi-scale modeling and simulation
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