



U.S. ARMY  
**RDECOM**

Dynamic Failure Modeling of Brittle Materials

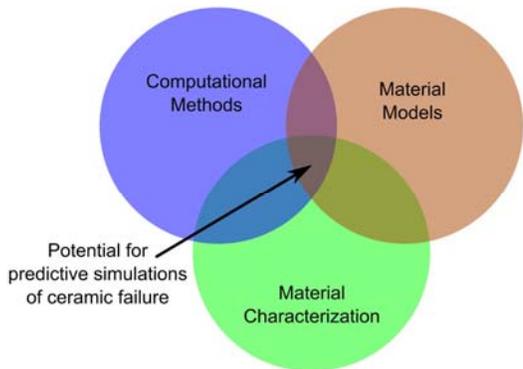


S&T Campaign: Sciences for Lethality & Protection  
*Ballistics and Blast*

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### Research Objective

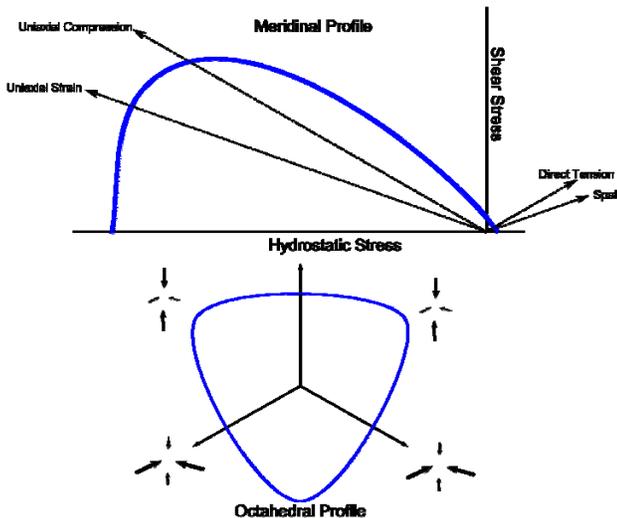
- Develop predictive capabilities for modeling projectile interactions with armor grade ceramic materials
- Provide robust, transferable, and efficient predictions of material failure and fragmentation by unifying computational approaches and model development



Predictive simulations of brittle failure require efforts in material modeling, computational methods, and material characterization

### Challenges

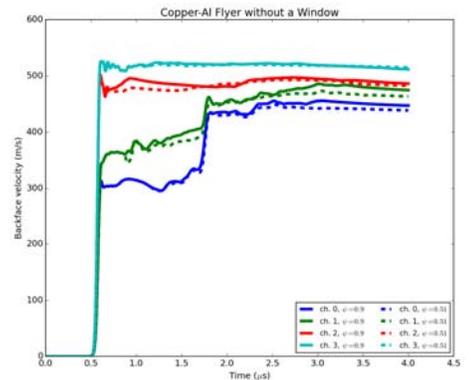
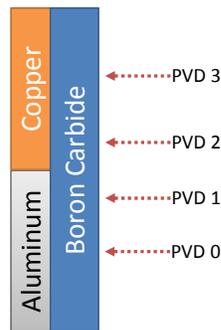
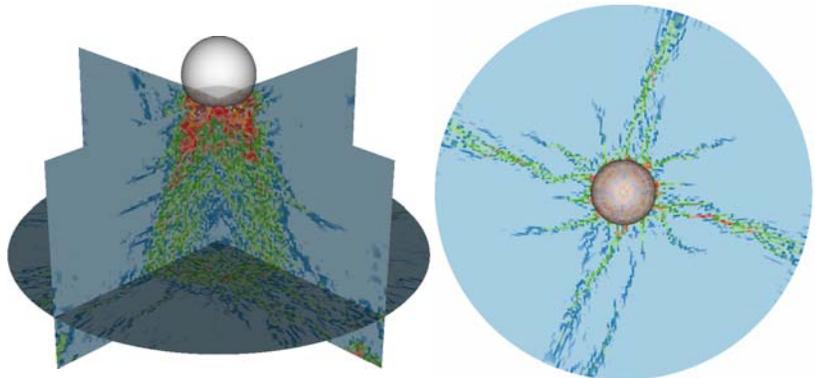
- Experimentally accessible stress paths are limited
- Using ballistic data for model calibration limits the available data for validation
- Simplified experiments should be used for calibration



Fragmented material is pressure dependent and likely sensitive to the Lode angle; however there are limited stress states that can be reached experimentally

### ARL Facilities and Capabilities Available to Support Collaborative Research

- Scalable DOD/DOE hydrocodes and computing resources to run high resolution simulations of experimental configurations
- Material model development and transition expertise
- The Tonge-Ramesh model was expanded and implemented in two DOE hydrocodes and one production DOD code
- The model is being used to evaluate sensitivities in existing experimental setups and design new experiments



### Complementary Expertise/ Facilities/ Capabilities Sought in Collaboration

- Methods for model calibration and uncertainty analysis
- Innovative experimental techniques that can access different regions of stress space for model calibration
- Approaches that will enable model parameter estimation from similar materials that are easier to characterize