Extended Solids as Disruptive Energetics

S&T Campaign: Sciences for Lethality and Protection
Kinetic Lethality
Propulsion and Launch

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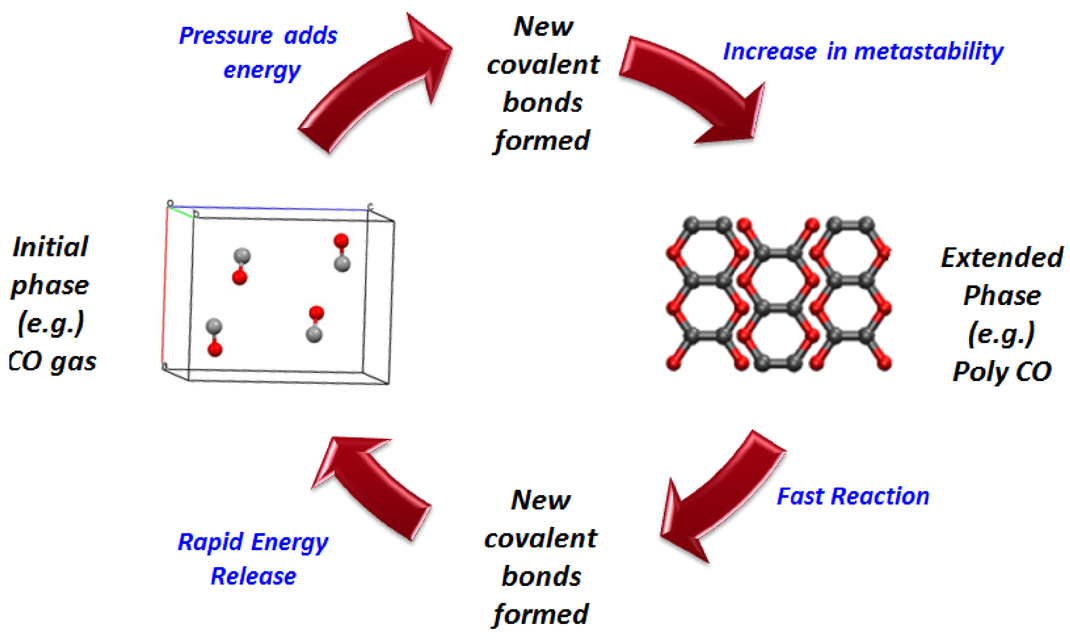
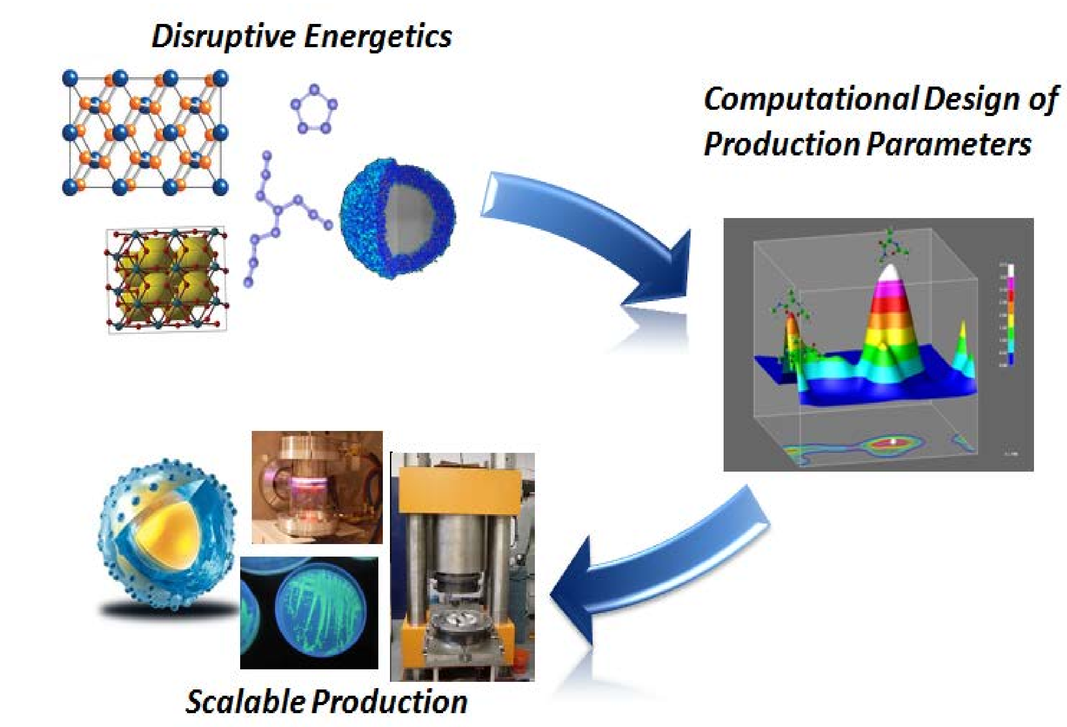
Research Objective

- **Extended Solids are formed from simple molecular gases (N_2, H_2, etc) placed under extreme conditions of pressure and/or temperature**
- **Development of the conditions needed to form extended solids, stabilization routes, small scale thermochemical characterization, and investigation of mechanisms to release the stored structural energy.**
- **Significant improvements in a variety of lethality applications are possible (i.e. 3-5 times the energy density, increased blast output, new burn rate modifiers for propellants, etc).**



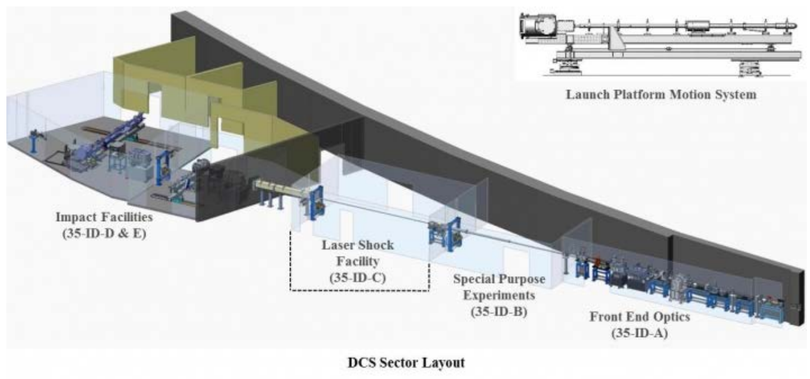
Challenges

- **Research is needed to better understand pathways to increase the metastability of the extended solid to include that of ambient conditions**
- **Development of scalable pathways**
- **Demonstration of scaled production technique amenable to large scale synthesis**
- **Demonstration of performance characteristics on small scale.**

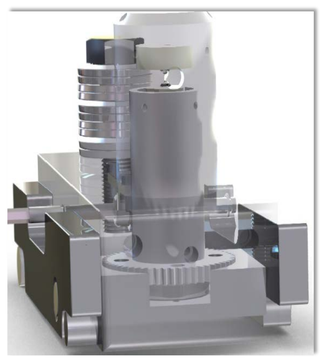


ARL Facilities and Capabilities Available to Support Collaborative Research

- **A broad range of high-pressure resources are available: diamond anvil cells, large volume cells, rotational diamond anvil cells, high-temperature capability**
- **Raman and Infrared Spectroscopy at various wavelengths, Reflectivity, Optical Imaging, CARS**
- **Dynamic Compression Sector at Advanced Photon Source**
- **Full suite of Analytical Testing Capability (DSC, calorimetry, TGA, SEM, NMR, etc)**



DCS Sector Layout



Collaborative Expertise/Facilities and Capabilities Sought

- **Expertise in design of high-pressure vessels**
- **Expertise in structural analysis of new materials, including x-ray diffraction and PDF for amorphous/glassy materials**
- **Expertise in high-pressure experiments for the identification of new systems of interest**
- **Expertise in characterization of material properties under dynamic conditions**
- **Expertise in modeling and simulation techniques to help understand phenomena occurring at various length scales**