# Modeling the Dynamic Response of Magnesium

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

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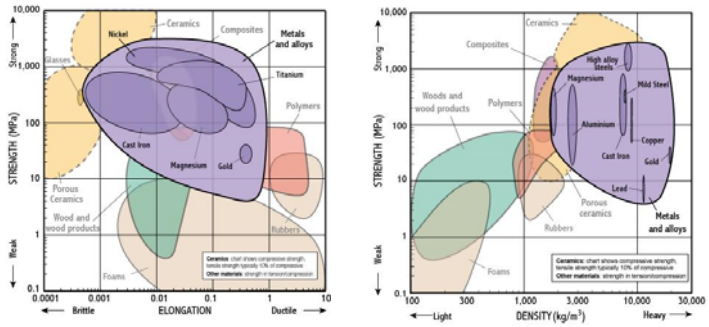
## Research Objective

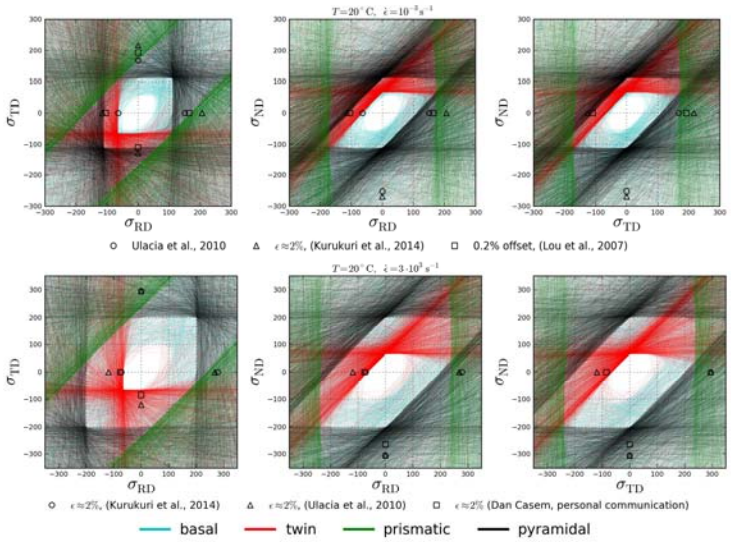
- Develop constitutive models for HCP metals valid at multiple strain rates, so that microstructure optimization can be performed for dynamic loading
- Identify ideal HCP microstructures based on performance-limiting mechanisms




Ashby diagram used to identify materials that possess low density, high strength, and high ductility. Source: http://www-materials.eng.cam.ac.uk/

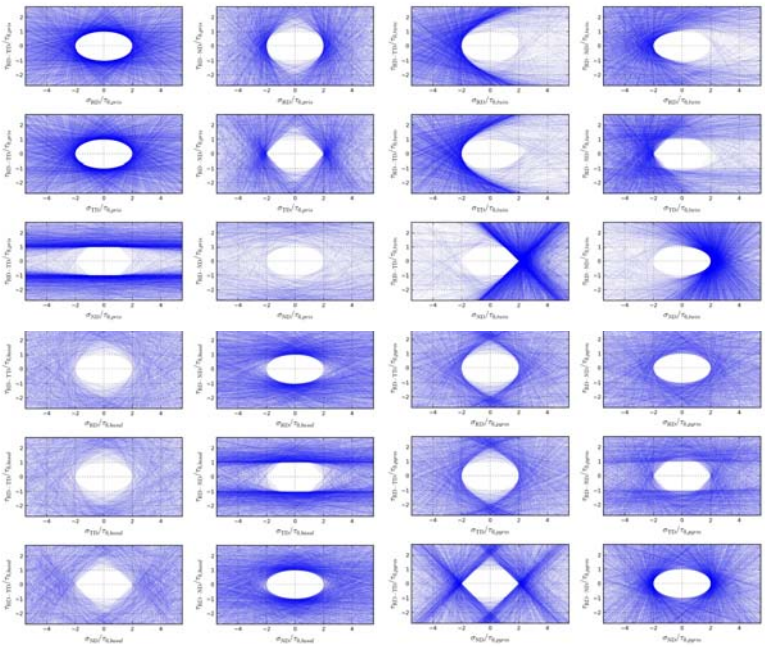
## Challenges

- HCP metals do not behave isotropically, so understanding and exploiting directionality is essential
- Conventional testing methods do not sufficiently characterize the material response




Computed deformation mechanisms and associated yield locus for rolled Magnesium AZ31B compared to experimentally measured values under quasistatic and dynamic loading conditions

## ARL Facilities and Capabilities Available to Support Collaborative Research



- XRD and EBSD materials characterization for understanding crystal orientation distributions
- Mechanical materials response measured under various deformation modes from strain rates of $10^{-4}$ up to $10^{6}$ $s^{-1}$
- Expertise in physically-based constitutive model development, implementation, and verification for high rate applications using a variety of commercially available (e.g., ABAQUS) or proprietary (e.g., ALE3D) codes
- Massively parallel HPC systems for high-fidelity simulation of engineering-scale problems

## Complementary Expertise/ Facilities/ Capabilities Sought in Collaboration

- Facilities with known expertise and capabilities for alloy development
- Facilities with large, accessible electronic databases of materials with known processing history and measured mechanical responses
- Develop modeling capabilities in parallel with large production end users
- Develop advanced dynamic in-situ materials characterization methods for metals