Stabilizing and Synthesis of Nanocrystalline Alloys for Future Army

S&T Campaign: Materials Research
High Strain Rate and Ballistic Materials

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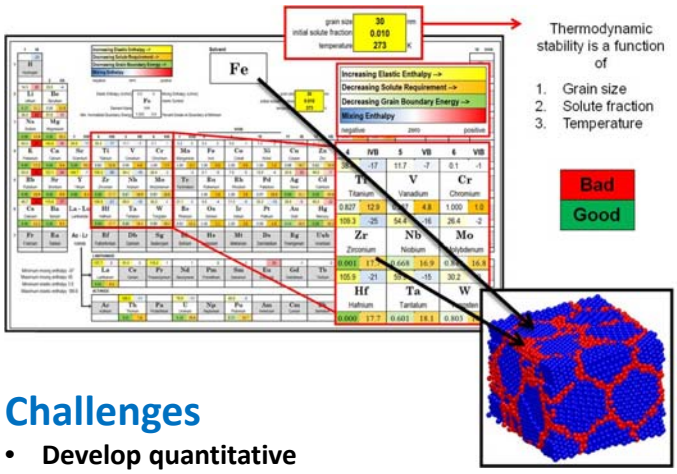
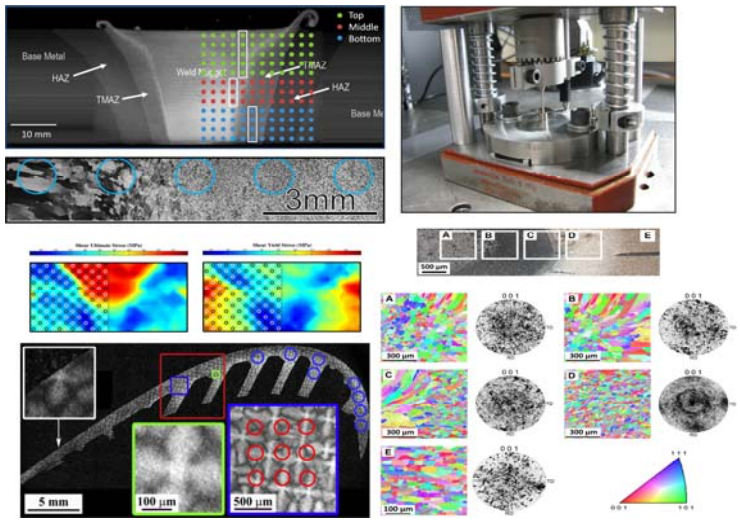
Research Objective

- Develop bulk, thermally stable nanocrystalline materials with tailored properties for Future Force structural and ballistic applications.
- Establish structure processing property relationships utilizing advanced computational and characterization techniques



Challenges

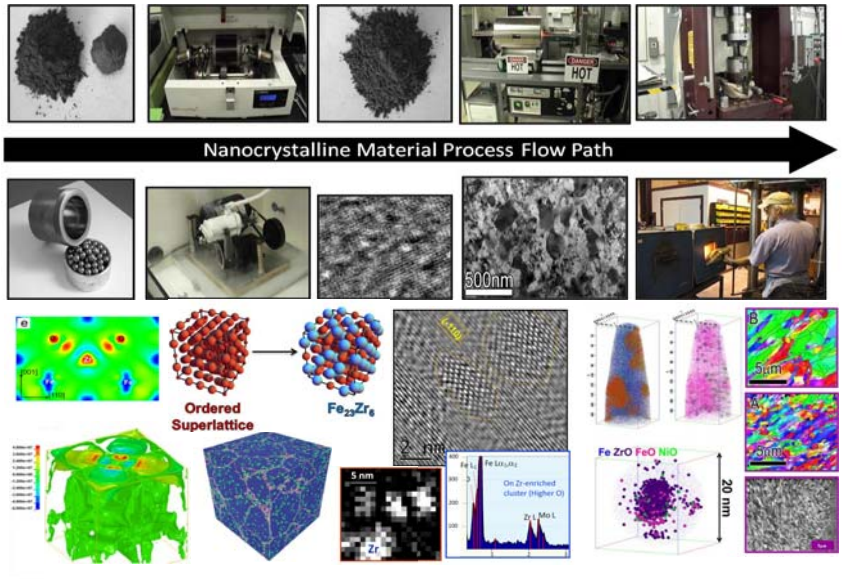
- Develop quantitative understanding of interfacial science to predict stability
- Extract this information, using sophisticated electron microscopy techniques for atom-by-atom analysis of interfacial structures
- Advanced computational modeling of complex structures
- Novel small scale mechanical testing
- Forge new territory in process consolidation



Novel Small Scale Testing

ARL Facilities and Capabilities Available to Support Collaborative Research

- Concept and rapid assessment powder metallurgy laboratory
- Large scale prototype powder metallurgy laboratory
- Small scale mechanical testing laboratory
- Analytical and structural characterization



Complementary Expertise/ Facilities/ Capabilities Sought in Collaboration

- Large Scale Process Consolidation: HIPing, Extrusion and or other high temperature forging techniques.
- Aberration corrected transmission electron microscopy
- Melt-spinning and spray atomization for novel powder feed synthesis
- Expertise in Thermocalc for phase diagram and precipitate evolution

REFERENCE:

1. KA Darling, MA Tschopp, RK Guduru, WH Yin, Q Wei and LJ Kecskes: *Microstructure and mechanical properties of bulk nanostructured Cu-Ta alloys consolidated by equal channel angular extrusion*: Acta Materialia, 2014. 76(1): p. 168-185.
2. KA Darling, MA Tschopp, BK Vanleeuwen, MA Atwater, ZK Liu: *Mitigating grain growth in binary nanocrystalline alloys through solute selection based on thermodynamic stability maps*: Compt Mat. Sci., 2014. 84: p. 255-266.
3. KA Darling, AJ Roberts, L Armstrong, D Kapoor, MA Tschopp, LJ Kecskes and SN Mathaudhu*: Influence of Mn solute content on grain size reduction and improved strength in mechanically alloyed Al–Mn alloys: Mat. Sci. Engr. A*, 2014. 589: p. 57–65.

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