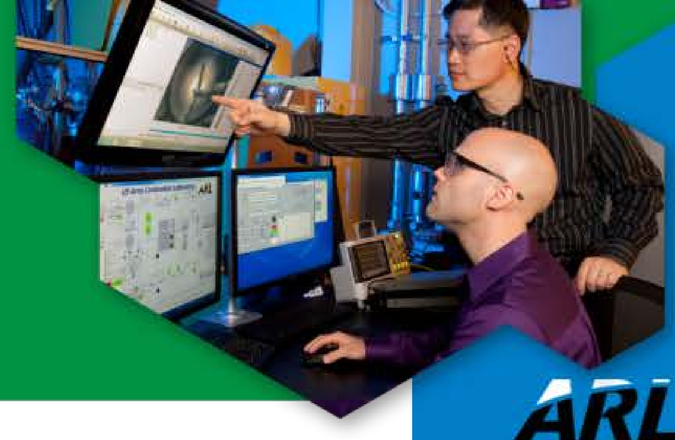
Deformation Processing of Lightweight Materials

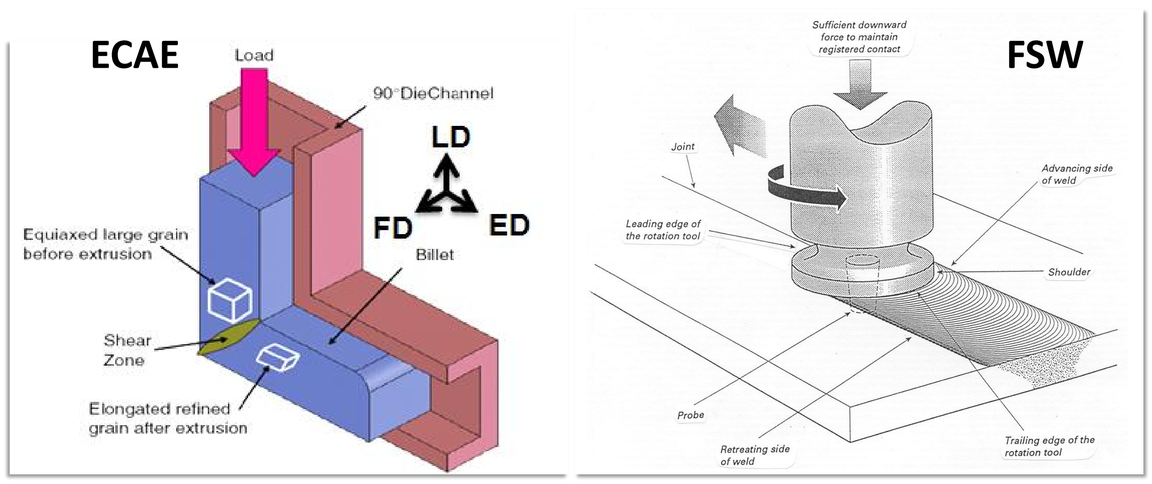


S&T Campaign: Materials Research
Tier 2 Manufacturing Science, Processing & Sustainment

Dr. Kevin J. Doherty, (410) 306-0871
kevin.j.doherty18.civ@mail.mil

Research Objective

- **Investigate and exploit severe plastic deformation processing technologies that allow the control of microstructure and the resulting mechanical properties**
- **Determine processing/microstructure/properties relationships for high performance, lightweight metals**
- **The evaluation of deformation processing technologies has pushed the strength levels of different lightweight metal systems to new levels for both structural and protection applications**



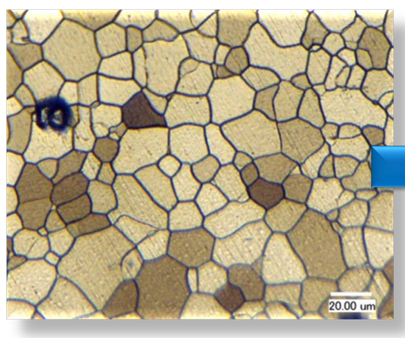
Scalable severe plastic deformation methods

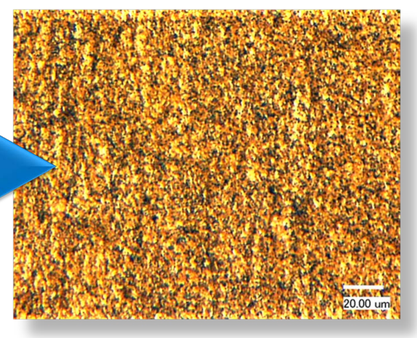
Challenges

- **Determining and applying the relationship between processing/microstructure/properties at multiple rates and different length scales**
- **Determining and exploiting the similarities and differences in the various lightweight metal systems**

ECAE – 12”x12”x1” Mg Plate

Friction Stir Processing

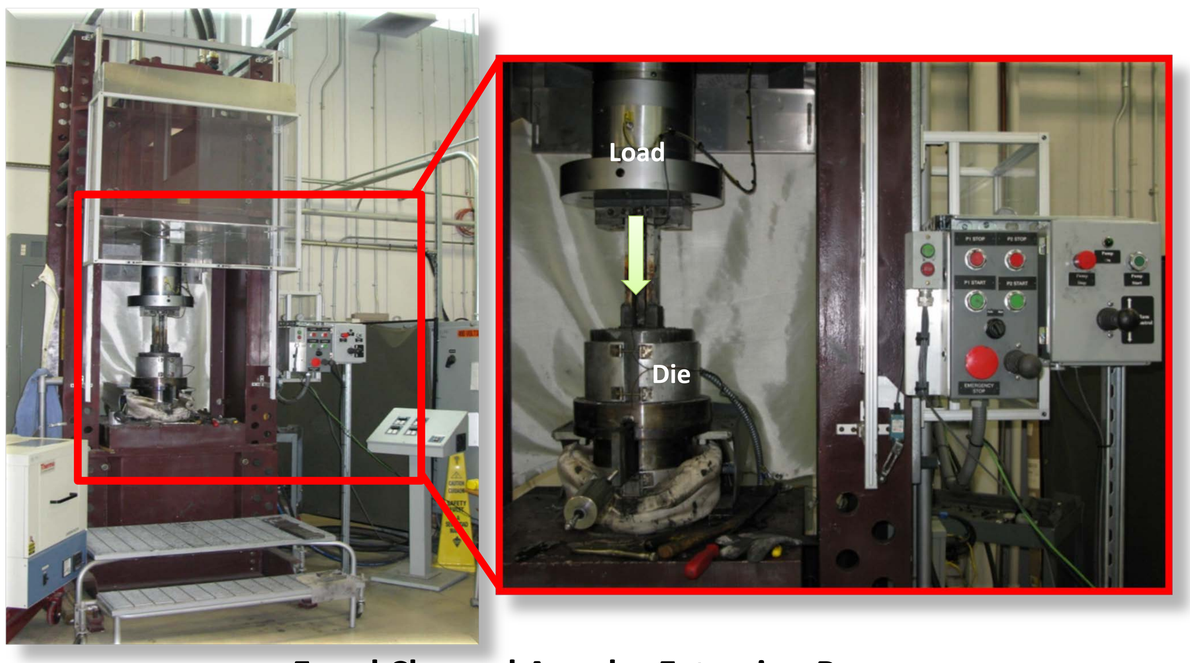




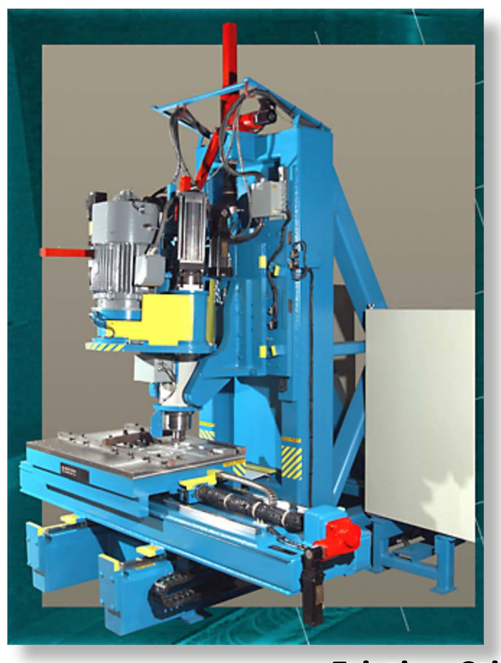
Grain size reduction via severe plastic deformation methods

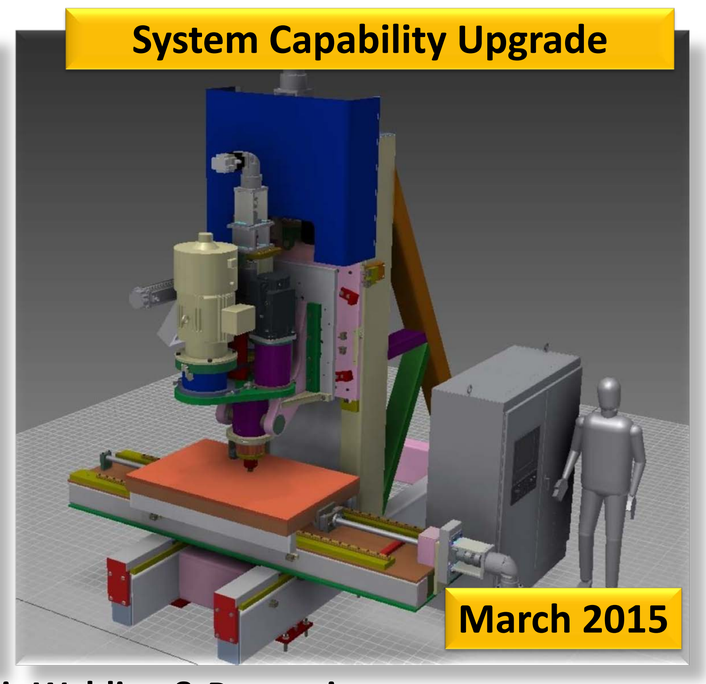
ARL Facilities and Capabilities Available to Support Collaborative Research

- **Equal Chanel Angular Extrusion (ECAE) Machine**
  - **Plate and Bar Tooling Geometries**
- **Thermo-Calc**
- **Analytical and structural characterization**
- **Multi-scale material modeling**
- **Friction Stir Welding (FSW)/Processing Machine (March 2015)**



Equal Channel Angular Extrusion Press





Friction Stir Welding & Processing

Complementary Expertise/ Facilities/ Capabilities Sought in Collaboration

- **Multiaxial forging, twist extrusion and other scalable severe plastic deformation manufacturing technologies**
- **Processing sciences which employ the use of intense fields (acoustic, electro-magnetic and/or magnetic, etc.) for the purpose of controlling phase transformations, grain growth, and/or recovery of strain hardening**