



U.S. ARMY
RDECOM

Deformation Processing of Lightweight Materials

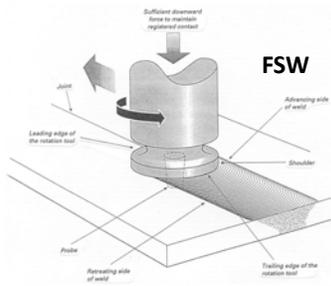
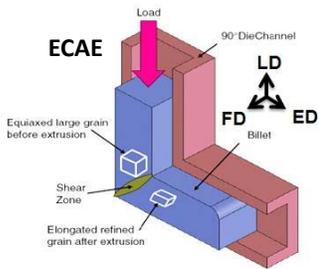


S&T Campaign: Materials Research Materials Manufacturing Science

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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

ARL Facilities and Capabilities Available to Support Collaborative Research

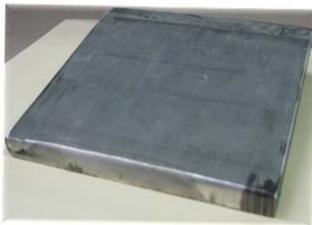
- Equal Channel Angular Extrusion (ECAE) Machine
 - Plate and Bar Tooling Geometries
- Thermo-Calc
- Analytical and structural characterization
- Multi-scale material modeling
- Friction Stir Welding (FSW)/Processing Machine (March 2015)



Equal Channel Angular Extrusion Press

Challenges

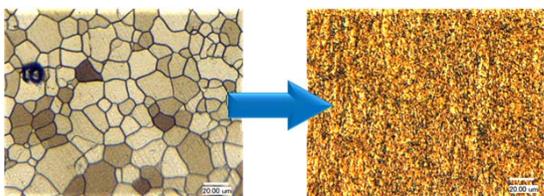
- Determining and applying the relationship between processing/microstructure/properties at multiple rates and different length scales
- Determining and exploiting the similarities and differences in the various lightweight metal systems



ECAE – 12"x12"x1" Mg Plate



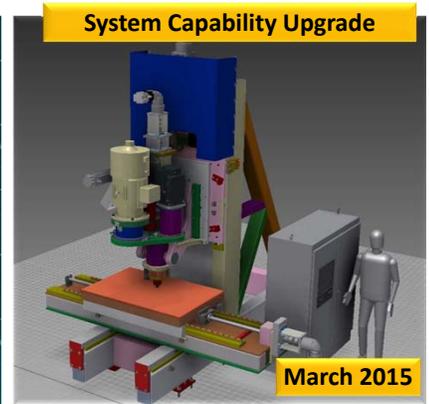
Friction Stir Processing



Grain size reduction via severe plastic deformation methods



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