

# Multiphysics Integrated Modeling of Self-Reacting Friction Stir Welding

**PI:** Xun Liu, The Ohio State University

**Co-I:**

Wei Zhang, The Ohio State University

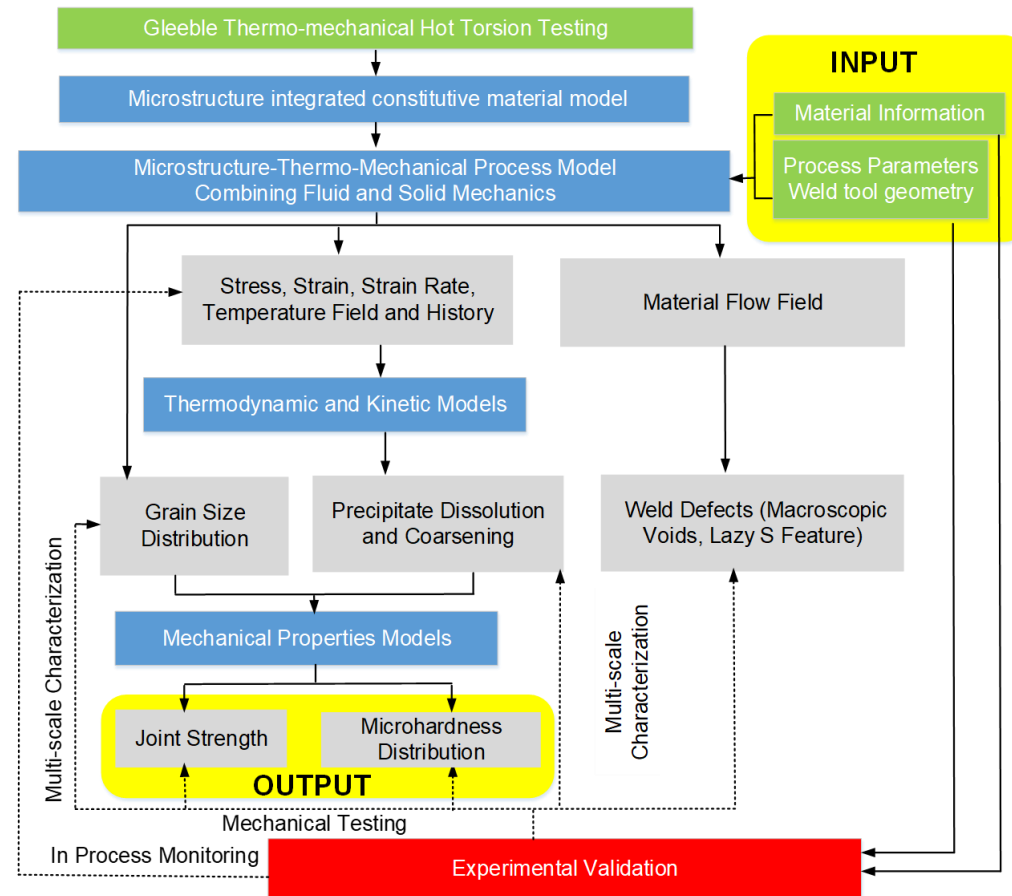
Antonio Ramirez, The Ohio State University

## Approach:

- (1) Develop a microstructure integrated material constitutive model
- (2) Develop a hybrid fluid dynamics-solid mechanics process model
- (3) Combine precipitate evolution and structure-property relationships with the process model to predict weld strength
- (4) Validate models with in situ process monitoring, multi-scale weld characterization and mechanical testing

## Objectives:

- Develop a holistic computational tool for SRFWSW, which inputs tool geometry, process parameters and outputs weld performance
- Leverage the fidelity, robustness and efficiency of existing FSW models in SOA
- Innovate material constitutive models and hybrid process model
- As a fundamental research, the project starts at TRL2 and ends at TRL4



## Potential impacts:

- Fundamentally transform the FSW weld process development route using physics based models
- Foundation for an integrated software widely usable by process development engineers
- Significantly invigorate application of integrated computational material engineering (ICME) in solid state manufacturing processes