Integration of accurate local flow stresses into the modeling of the self-reacting friction stir welding process in AA 2219-T87

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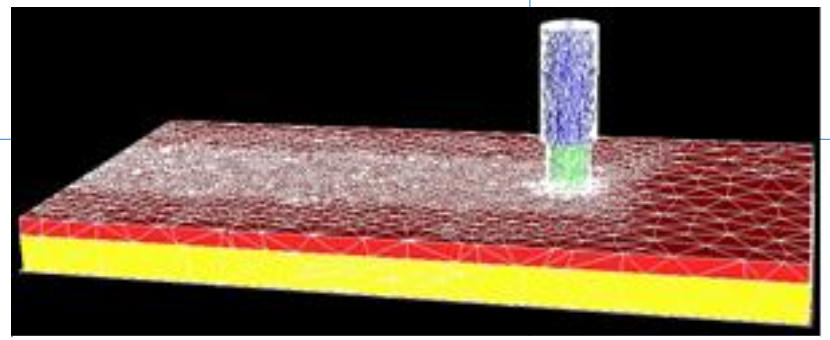
Research Objectives

- Provide more fundamental understanding of local flow stresses and microstructure in HGZ.
- Create a methodology for modeling local flow stresses in HGZ that can be integrated into existing FSW models.
- Proposed method aims to better characterize local flow stresses in HGZ over a variety of strain rates and temperatures, so that model can adapt to different process conditions without frequent friction parameter adjustments.
- The local flow stress and associated microstructure work corresponds to TRL 1-2. After model validation it is anticipated that the resulting process insights into self-reacting friction stir welding will be at TRL 3.



Simulation of Friction Stir Welding

Approach

- Develop new method to accurately measure and model local flow stresses at tool/material interface in friction stir welding (FSW) of aluminum.
- Use simple, flat FSW tool and inverse parameter identification to characterize the heat generation zone (HGZ) near the tool surface.
- Integrate local flow stress model into finite element simulation of FSW for standard tooling and for self-reacting FSW tooling.

Potential Impact

- FSW models require frequent adjustment of friction coefficients in order to obtain agreement with experiment when parameters of process are changed.
- Improved HGZ characterization will enable simulations to be far more useful in rapid development of FSW for aerospace/space structure applications, using FSW and self-reacting FSW.