SOUTH DAKOTA SCHOOL OF MINES & TECHNOLOGY

AMP SDSM&T

National Science Foundation
Center for Friction Stir Processing

Study of Distortion on Friction Stir Welded 7075-T6 Aluminum Plates

CFSP Center for Friction Stir Processing
http://cfsp.sdsmt.edu

NSF

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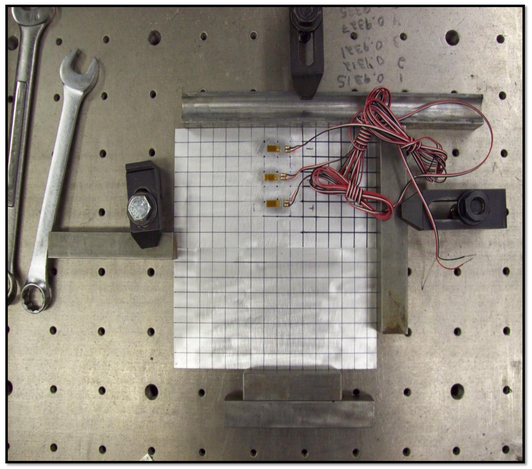
Objective

- Determine the effects of variables on distortion
- Measure the strain fields as a function of process variables
- Measurement of residual stress as a function of variables
- Determine distortion in stiffened panels with optimized parameters

Approach

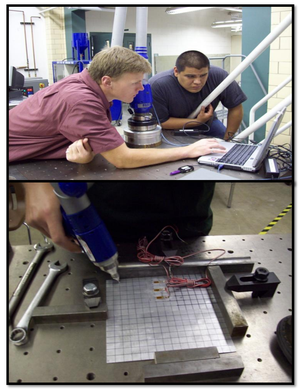
- Using the Faro Arm surface mapping tool determine the distortion induced during FSW.
- Map the surface of 4 in. wide by 8in. long specimen pairs of 0.040 in. 7075-T6 Aluminum plate before and after FSW and try to determine the distortion.
- Attach 3 Strain gages of type CEA-13-120-EU to one of each specimen set to determine induced strain due to the FSW.
- Calculate Surface Strain due to FSW.
- Quantify Distortion of the welded aluminum plates.



Actual Photo of Specimen Preparation

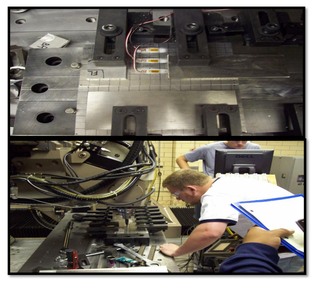
Experiments

Collecting FARO Arm Measurements



Welding the Specimens

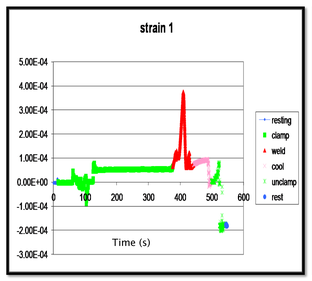
Weld Parameters	
Rotational Speed	1200, 900, 600 rpm
Traverse Speed	10 ipm
Weld Depth	0.029 in
Position Control Weld	



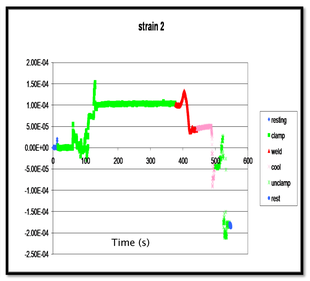
Pin Parameters	
Shoulder Diameter	0.249 in
Pin Diameter	0.086 in
Pin Length	0.029 in
2° Roll	

Results

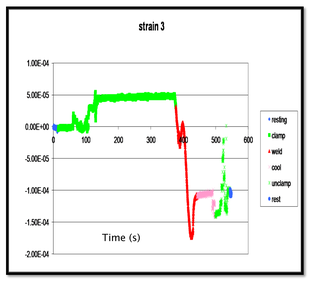
Strain Data



FSW-09035-34 Strain 1



FSW-09035-34 Strain 2

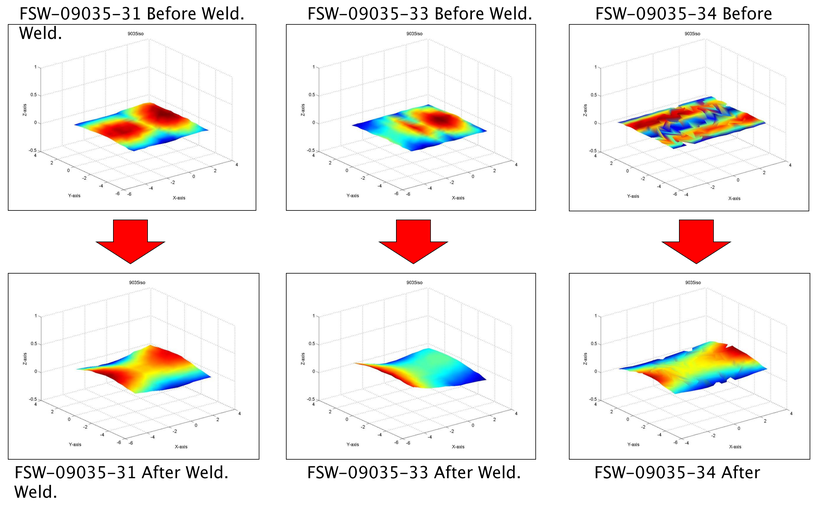


FSW-09035-34 Strain 3

Quantifying Distortion

Z-axis Position	D=Σ|Zi-Zf|
Specimen	Distortion Index
09035-31	20.1521
09035-33	25.1127
09035-34	17.4232
09035-35	17.1474
09035-36	16.6752
09035-37	24.5089

FARO Arm Mappings



Conclusions and Future Work

- The Faro Arm is a useful tool for visualizing distortion in a plate.
- The Faro Arm is inconsistent enough that it does not seem to be a useful tool for determining strain.
- Strain Data shows clamping causes a significant amount of strain.
- Z axis quantification index appears to show higher distortion with higher index and lower distortion with lower index.
- Rotational Speed has little influence on distortion of panels.
- Further testing of specimens with different welding parameters.
- Develop a procedure to reduce distortion in Friction Stir Welding.

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