SURFACE INTEGRITY INSTITUTE

Mitigating Stress Cracking in Weldments

Relieving Tension to Improve Performance

Supported by:

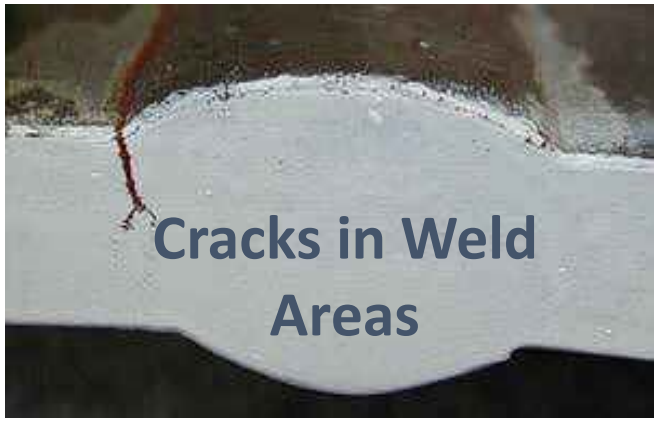
LAMBDA Technologies Group

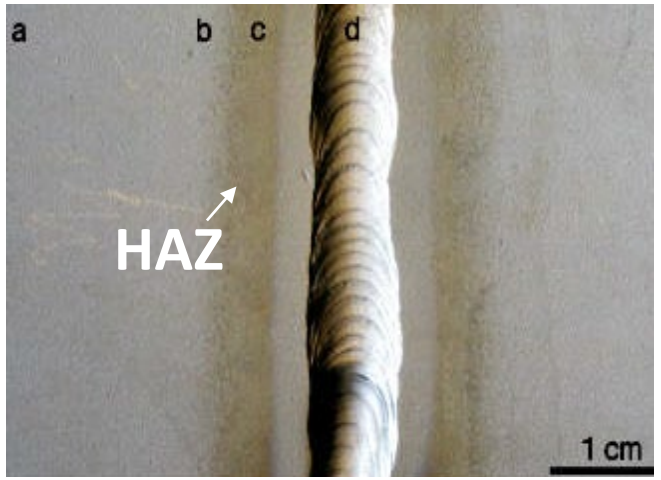
Detrimental Effects of Weld Tension

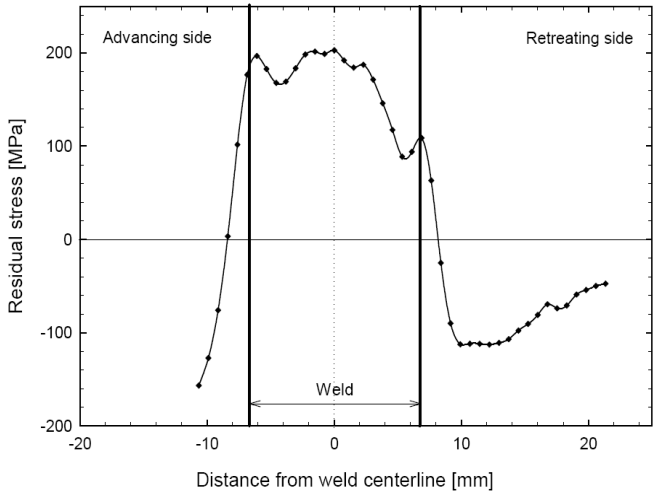
- Caused by tensile residual stresses in the weldment and adjacent regions due to shrinkage from solidification of weld bead
- Stress concentration at the weld toe (or weld roots) – base metal interface
- Degradation of material properties in the heat affected zone (HAZ)
- Residual tension leads to cracking

Consequences

- Potential catastrophic failure
- Premature retirement of components from service
- Frequent inspection







Residual Stress in Ti-6Al-4V Friction Stir Weld

SURFACE INTEGRITY INSTITUTE

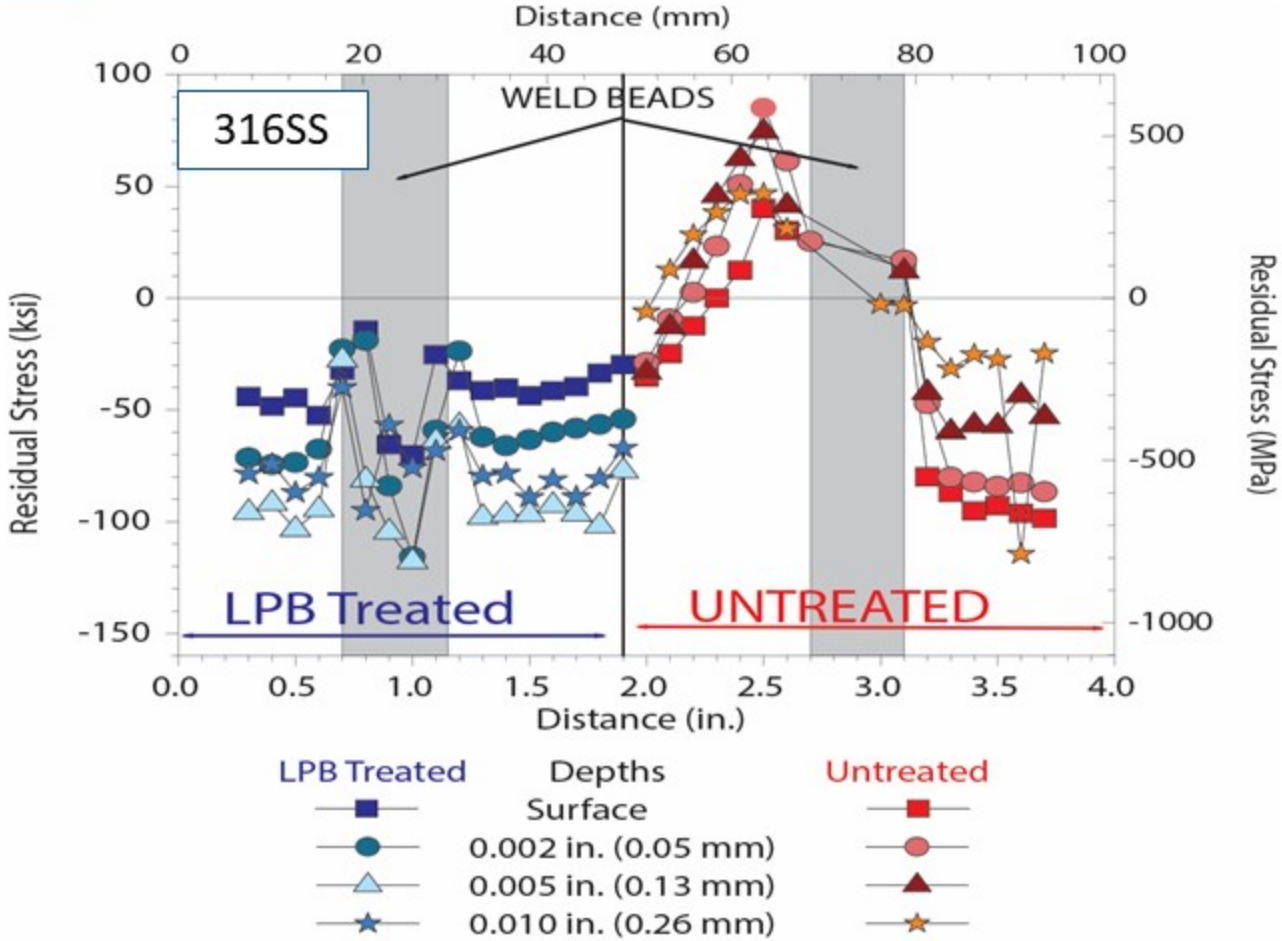
Common Treatments

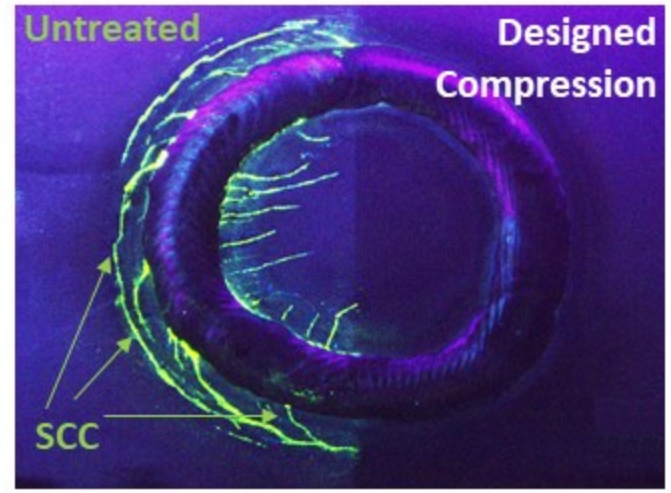
- **Post-weld heat treatment – May not be possible in large components and more complex components**
- **Preheating the component to minimize tensile residual stresses – Increases cost of production; may not be physically possible in all components**
- **Adjusting weld parameters to minimize HAZ – Cost prohibitive**
- **Multi-pass welding to minimize stress concentration at weld-roots – Increases costs, negatively impacts production rates**

These treatment methods aim to minimize tension in welds with varying degrees of success.

SURFACE INTEGRITY INSTITUTE

Designed Compression





Benefits

- Extend Component Life
- No Material Replacement
- Improve Damage Tolerance
- Reduce Risk of Failure
- Improve Cost Savings
- No Change in Weld Technique
- No Redesign

Extend Component Life with Designed Compression
A Cost-Effective Solution to Relieve Weld Tension

SURFACE INTEGRITY INSTITUTE