Laser Shock Peening for the Maritime Industry

Applying Proven Material Treatment in Innovative Ways to Increase Performance

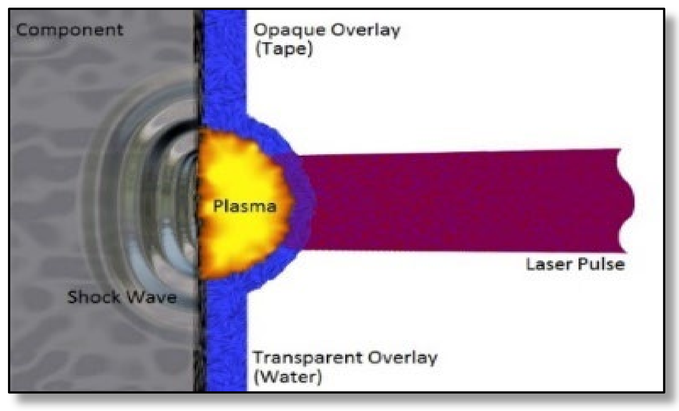
Team: Hepburn and Sons LLC | LSP Technologies Inc. | Vigor Industries | ABS

Problem

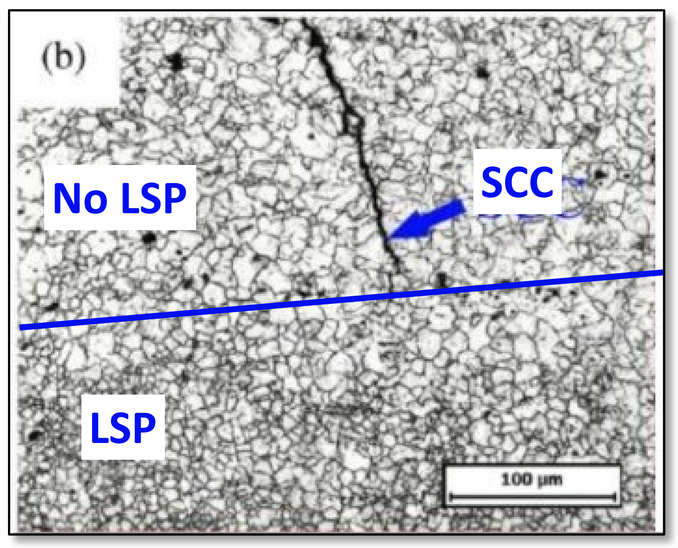
- Stress corrosion cracking and sensitization is a growing problem with Aluminum
- Repair yards are tasked with these substantial and costly repairs
- Aluminum repair requires significant and difficult rework increasing labor costs
- Welding repairs impart high heat, stress, and deformation of aluminum
- Flame straightening not permitted on marine grade aluminum
- Common aluminum forming methods are laborious, costly, reducing operational readiness

Solution

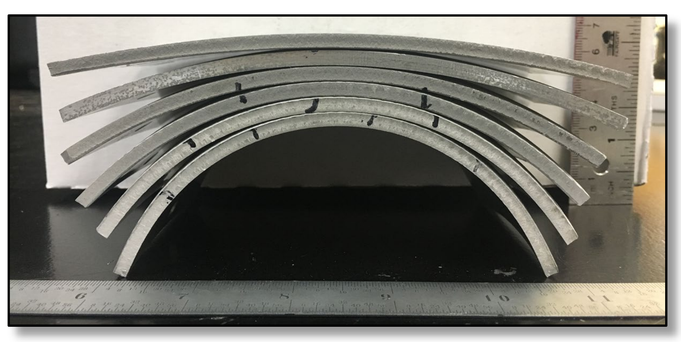
- High-energy laser directed at material surface to generate pressure pulses
- Shock wave plastically yields and cold works the material to generate deep compressive stresses
- Residual stress layers are much deeper than that achievable with other peening methods
- Highly predictive and deterministic stress profiles achieved with tunable laser
- Used successfully in the aerospace industry for over 20 years
- Significantly improves aluminum lifespan increasing time between availabilities
- Arrests crack growth and mitigates stress corrosion cracking improving operational availability
- Allows shaping complex geometries in metals with little to no heat



LASER SHOCK PEENING



ARREST STRESS CORROSION CRACKING



FORM COMPLEX SHAPES

Project Benefits

- Enhanced fatigue resistance
- Enhanced corrosion resistance
- Enhanced cracking resistance
- Increased service lifetimes
- Reduced maintenance costs
- Repeatable precision forming
- Coldworking process
- Portable – shipboard hardware

Project ROI

- Thousands of cracks/hull mitigated
- Save $M's of aluminum repair costs
- First ever shipboard laser peening
- Optimized system for mobility
- Supported by shipboard utilities
- Fiber optic cable enables reach
- Could be used below deck

Hepburn and Sons LLC

LSP Technologies

VIGOR

ABS

Proven Technology Used For 20+ Years and Certified in High-Risk Applications in the Aerospace and Nuclear Power Industries to Improve the Fatigue Life of Parts

10X Compressive Residual Stress Benefits Over Other Peening Methods and Treatments

Up to 48X Lifetime Extension of Sensitized Aluminum

Mitigates Stress Corrosion Cracking and Exfoliation in Aluminum Alloys

Coldworking Process Used to Form Complex Shapes