LAMBDA Technologies Group

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Improving Component Life and Performance

Sensitized Marine Aluminum

A commonly used alloy in shipbuilding, AA5083-H116, is becoming even more prevalent in marine applications as the Navy pursues lighter and faster ships, such as the new breed of aluminum-hulled Littoral Combat Ships (LCS). However, alloys of this series are prone to low-temperature sensitization, which leads to beta-phase (Mg_2Al_3) precipitation along grain boundaries. This increases susceptibility to stress corrosion cracking (SCC) and corrosion fatigue (CF) and is an issue commonly found in heat-affected zones from welding as well as in areas subjected to prolonged exposure to other heat sources such as sunlight. The United States Navy has issued a directive to solve this problem as it dramatically affects operation and maintenance costs and fleet performance.

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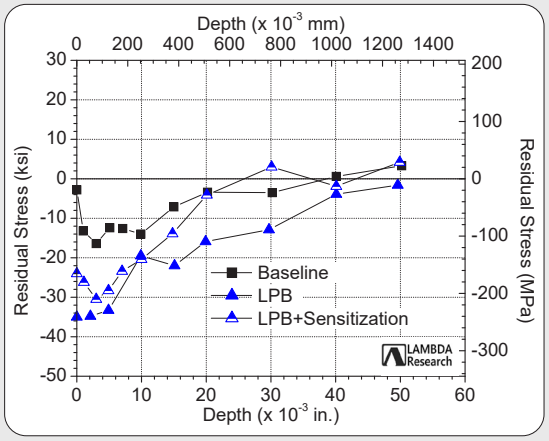
SOLUTION: The research team at Lambda Technologies designed a study that showed how engineered deep residual compression, applied with Low Plasticity Burnishing (LPB), can mitigate SCC and high cycle corrosion fatigue in sensitized 5083 aluminum.

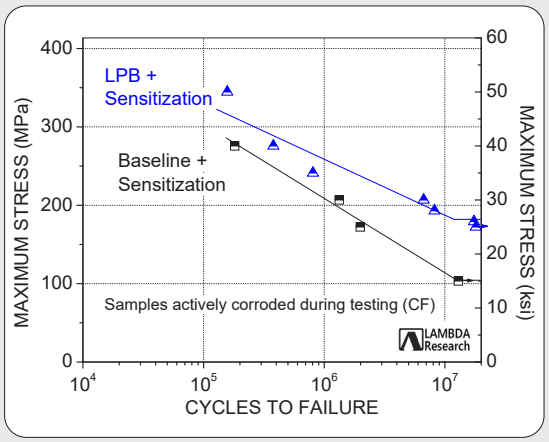
Baseline and LPB processed AA5083-H116 HCF samples were artificially sensitized using a computer-controlled oven at 90°C for 240 hours. The degree to which the material was sensitized was quantified by ASTM G67 nitric acid mass loss tests, and XRD residual stress measurements showed that about 70% of the beneficial compression achieved from LPB processing was retained after sensitization.

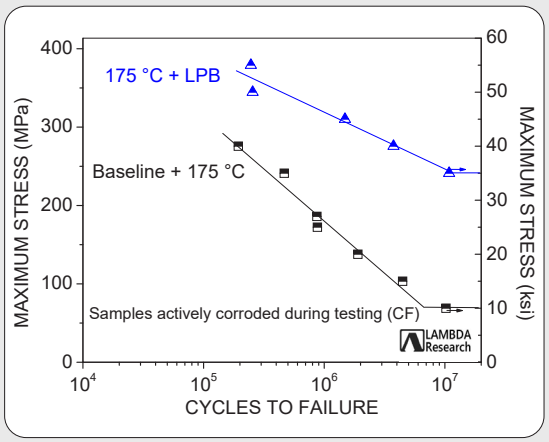
High cycle corrosion fatigue testing was performed by applying a saturated NaCl salt pad to the surface of the sample, ensuring that the sample is actively corroding during testing. Results showed improved corrosion fatigue performance for the LPB processed samples, with an endurance limit increase of about 70% over baseline.

Additional testing of a more severe sensitization event (175°C for 240 hours) showed that LPB, when applied after the event, completely mitigated the deit from sensitization and corrosion and restored performance back to that of the original baseline condition.

See our website for the full report, including additional testing and analysis not covered here.







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