Stress Corrosion Cracking Resilience of Aluminum Welding Joints

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Stress Corrosion Cracking (SCC) is a significant challenge affecting the integrity and reliability of aluminum welding joints, particularly in marine and aerospace applications. This study investigates the SCC behavior of aluminum as a base metal, aluminum Tungsten Inert Gas (TIG) welding joints, and aluminum TIG joints with stress-relieving post-weld heat treatment. The results indicate that the SCC thresholds for aluminum, aluminum TIG joints, and aluminum TIG joints with stress relieving are 30.454 MPa, 20.648 MPa, and 25.551 MPa, respectively. It can be concluded that the welding process increases susceptibility to SCC, making the welded joints more vulnerable to cracking under stress. However, implementing stress-relieving post-weld heat treatment significantly improves the SCC resistance of aluminum welding joints by reducing residual stresses and enhancing their overall mechanical properties. These findings highlight the importance of stress-relieving treatments in improving the durability and performance of welded aluminum structures in demandi ng environments.

Index Terms—Aluminum Welding Joints; Stress Relieving Post Weld Heat Treatment; Stress Corrosion Cracking – SCC; Stress Corrosion Cracking Threshold $\sigma_{th\text{-}SCC}$