

## Stress corrosion crack initiation and propagation characteristics of 7xxx high-strength Al alloy

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**Abstract** High-strength 7xxx aluminum alloy is widely used in aerospace and ocean engineering as structural materials, causing a risk of stress corrosion crack (SCC) in equipment [1]. Different from previous works, the slow strain rate tensile (SSRT) and constant load tensile (CLT) tests were innovatively designed in conjunction, and the electrochemical activity of metal surfaces under different deformation states was analyzed by in-situ electrochemical test in this work. Stress distribution simulated by the finite element method (FEM) and mechanical experiments equipped with in-situ electrochemical analysis are utilized to research the SCC mechanism of 7xxx Al alloys in simulated marine environments that contain corrosive  $\text{Cl}^-$ . The results showed that different deformation states caused varying degrees of stress concentrations on the 7xxx sample after a slow strain rate test (SSRT) and constant load test held for 12 h in the simulated marine environment. The strain concentration coefficient ( $K_\epsilon$ ) of the plastic deformation sample was higher than that of the elastic deformation sample, due to the larger aspect ratio (width  $D$ /depth  $d$ ) of its pits. The severe plastic deformation sample ( $\epsilon_s=12.5\%$ ) had the highest SCC susceptibility, exhibiting large-scale and dense SCC crack generation due to micro-texture transformation and passive film defects.

**Keywords** Stress corrosion crack (SCC); 7xxx Al alloy; Microstructure; Pit-to-crack

### Reference

[1] H. Zhao, P. Chakraborty, D. Ponge, T. Hickel, B. Sun, C.-H. Wu, B. Gault, D. Raabe, Hydrogen trapping and embrittlement in high-strength Al alloys, *Nature*, 602 (2022) 437-441.