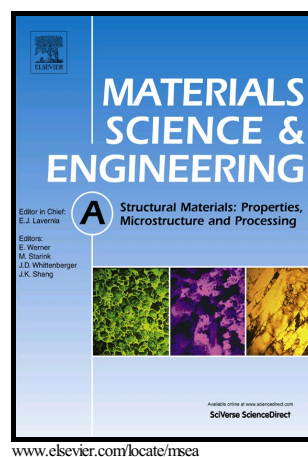


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Electrochemical Characterization and Stress Corrosion Cracking of E690 High Strength Steel in Wet-dry Cyclic Marine Environments

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Abstract: In this work, stress corrosion cracking (SCC) in E690 high-strength steel was investigated in simulated wet-dry cyclic marine environments using electrochemical techniques, constant load SCC examinations, morphology characterization via scanning electron microscopy (SEM), energy dispersive spectrometry (EDS) and X-ray diffraction (XRD). It was found that E690 steel exhibited high SCC susceptibility in wet-dry cyclic offshore environments. The SCC follows a combined mechanism of anodic dissolution and hydrogen embrittlement, which nucleate in pits beneath the rust layer and tend to propagate along bainite slices in a transgranular fashion. Cracks grow with a low propagation rate during the early stage and expand with a far faster rate when the crack size exceeds a critical value. Both the electrochemical and SCC behavior of the E690 steel in wet-dry cyclic environments were influenced by the rust layer. The rust scale causes enrichment of chloride in the sublayer and localized acidification. This synergistic effect is responsible for the mechanism and properties of SCC in this material.

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