

Investigating the Impact and Mechanism of Defect-rich Surface on the Pitting Resistance of 2205 Duplex Stainless Steel

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Abstract Enhancing the corrosion resistance of stainless steel is critically important. Surface plastic processing technologies can induce gradient microstructures, leading to a defect-rich surface [1] (DRS), which has been shown to effectively enhance the strength, toughness, and fatigue resistance of metals [2]. However, the influence of DRS on corrosion resistance is multifaceted, and whether it contributes positively to the corrosion resistance of stainless steel remains a subject of debate [3]. In this study, DRS was generated on 2205 stainless steel through surface mechanical rolling treatment. Comprehensive electrochemical testing and corrosion morphology analysis revealed a marked improvement in the pitting resistance of DRS 2205. The mechanisms underlying this enhanced corrosion resistance were explored from two key perspectives: the modification of surface inclusions and the improved protective properties of the passive film. These findings provide valuable insights into the potential of surface mechanical rolling and other plastic deformation techniques to further extend the application of stainless steels in highly corrosive environments.

Keywords Corrosion Resistance, Stainless Steel, Defect-rich Surface, Pitting, Inclusion, Passive Film

Reference

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