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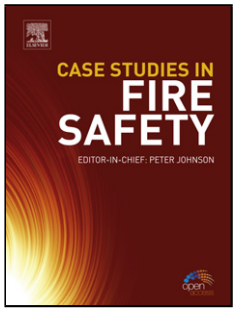

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A phase field model for simulating the stress corrosion cracking initiated from pits

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Abstract

This manuscript presents a new phase field model for simulating the stress corrosion cracking (SCC) phenomenon in metallic materials. To derive the phase field governing equations, the film rupture-dissolution-repassivation model is adopted as the operating mechanism for SCC. The effect of mechanical stresses is incorporated by relating the interface kinetics parameter to the stress intensity factor and stress field near the crack tip. Several numerical examples are presented to verify the accuracy of the proposed model. We also employ this model to investigate the effects of pit morphology, mechanical loading, and the metal microstructure on the SCC evolution.

Keywords: A. Stainless steel, B. Modeling studies, C. Stress corrosion cracking

1. Introduction

Pitting corrosion is the localized attack of the aggressive environment on the metal surface, which is initiated after the partial breakdown of the protective passive film [1]. In addition to causing the loss of functionality, this localized attack could considerably accelerate the mechanical failure by nucleating sites of stress concentration that would eventually lead to stress

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