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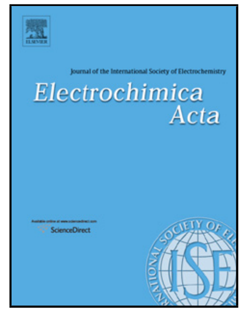

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Geometry influence on corrosion in dynamic thin film electrolytes.

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Abstract

Atmospheric corrosion is a complex problem, essentially an electrochemical process under confined thin electrolyte layers. Predictions require better mechanistic models to understand the underlying fundamental subprocesses on a microscopic level. We developed a mechanistic multi-ion transport and reaction model (MITReM) that considers time-dependent accumulation of concentrations in thin (NaCl) confined electrolyte layers. The model predicts local concentration and electrolyte potential distributions, from which corrosion rates are derived. Simulations in the confined dynamic film show that the chloride accumulation causes a deviation from the reverse proportionality of the corrosion current with the film thickness below films of 10 μm. The oxygen distribution and local corrosion current densities demonstrate that the contribution of the edge effect decreases for thinner electrolyte layers. The influence of the electrode geometry on the current density also decreases with decreasing film thickness. These qualitative insights are essential for the development of atmospheric corrosion prediction tools and aid in the design and interpretation of electrochemical techniques for confined thin film electrolytes.

Keywords: Atmospheric corrosion, modeling, thin electrolyte films, MITReM, FEM, Concentrated solutions

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