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研究报告

金属在湿大气环境下初期腐蚀行为的元胞自动机模拟

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摘要:

大气腐蚀是金属在自然环境下服役中常见的一种腐蚀现象。本文采用元胞自动机方法对金属在湿大气腐蚀环境下的腐蚀行为进行了模拟。根据元胞自动机的机理和金属在湿大气环境下的初期腐蚀机理的实验研究结果,建立了元胞自动机模型的演化规则,对金属腐蚀过程中的电化学反应和扩散过程进行了模拟。通过对元胞自动机模型在不同参数下进行的模拟结果,确定了能够比较真实反应腐蚀坑形貌的模拟条件。同时统计了电解质中各元胞的浓度分布,并对比湿大气环境下金属腐蚀的机理进行了分析和讨论,模拟结果与实际结果一致。

关键词: 元胞自动机 大气腐蚀 计算机模拟

CELLULAR AUTOMATA SIMULATION ON THE EARLY STAGES OF METAL CORROSION IN MOIST ATMOSPHERIC ENVIRONMENT

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Abstract:

Atmospheric corrosion was widely occurred when metallic materials were used in natural environment. This paper presents a cellular automata model which simulates the early stage of metal corrosion in moist atmospheric environment. First, the basic principles of cellular automata are introduced, and the application of cellular automata in corrosion field is briefly summarized. Then according to the mechanism of metal corrosion in moist atmospheric environment, the cellular automata model which will simulate the electrochemical reactions and diffusion steps of metal corrosion is proposed. With a series of simulation, the optimization factors which were used to simulate the evolvement of corrosion pit appearance are established. At the same time, the concentrations of different cells in electrolyte are simulated, and the trend of the concentration curve is analyzed contrast to the lab experiment.

Keywords: cellular automata atmospheric corrosion computer simulation

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