Electrochemical Corrosion Study of Zircaloy-4 in a LiOH Solution at High Temperature and Pressure

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The electrochemical corrosion of Zircaloy-4 in simulated pressurized water reactor coolant at 350°C was studied via in situ potentiodynamic polarization and electrochemical impedance spectroscopy (EIS) measurements. The potentiodynamic polarization results indicate that the corrosion potential of Zircaloy-4 decreases and its corrosion current density increases when the concentration of LiOH increases, showing that Zircaloy-4 corrodes more easily and faster in higher concentrations of LiOH. In addition, the EIS data fits the double layer oxide model, which consists of a porous non-protective outer layer and a dense protective inner barrier layer. The EIS data suggest that the corrosion resistance of the two oxide layers both decrease with the increasing LiOH concentration. Our study shows that increasing the LiOH concentration benefits the electrochemical corrosion of Zircaloy-4 in high-temperature and high-pressure aqueous solutions.

Keywords: Zircaloy-4; EIS; polarization; corrosion; oxidation; Modeling and Simulation

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