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Effects of Stress on Corrosion in a Molten Salt Environment

SAMUEL GIRDZIS, DENNIS MANOS, WILLIAM COOKE, The College of William and Mary — Molten salt is often used as a heat transfer and energy storage fluid in concentrating solar power plants. Despite its suitable thermal properties, molten salt can present challenges in terms of corrosion. Previous studies have focused extensively on mass loss due to molten salt-induced corrosion. In contrast, we have investigated how corrosion begins and how it changes the surface of stainless steel. Samples of alloys including 304 and 316 stainless steel were exposed to the industry-standard $\text{NaNO}_3\text{-KNO}_3$ (60%-40% by weight) mixture at temperatures over 500°C and then analyzed using Hirox, SEM, and TOF-SIMS. We compare the corrosion at grain boundaries to that within single grain surfaces, showing the effect of the increased internal stresses and the weakened passivation layer. Also, we have examined the enhanced corrosion of samples under mechanical stress, simulating the effects of thermal stresses in a power plant.

Samuel Girdzis
The College of William and Mary

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