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Evaluating Localized Corrosion Susceptibility of Austenitic Stainless Steels Exposed to Varying Nitrate to Chloride Ratio Droplets

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Austenitic stainless steels (SS), utilized extensively in coastal environments due to their enhanced corrosion resistance, are susceptible to localized corrosion and stress corrosion cracking (SCC) when exposed to chloride environments. One potential scenario under which SCC may pose a concern is the interim storage and the eventual transport of spent nuclear fuels (SNF) in SS canisters. The SS canisters may be subjected to marine sea-salts and elevated temperatures; however, assessing the current damage state on the surface of these canisters is difficult due to high radiation levels dictating confinement within a limited-access overpack. Hence, accelerated tests are needed in order to help predict potential materials degradation on the surface of these canisters. Another important factor related to SNF storage is the fact that the canisters are located in a variety of climates across the United States. Salt compositions and daily fluctuations of relative humidity (RH) and temperature differ widely by location. Of particular interest, inland sites have a higher nitrate concentration in comparison to coastal locations. One governing brine property for corrosion is the amount of nitrate present in the brine as this can serve to passivate a corroding alloy. Herein, we evaluate the influence of nitrate to chloride ratios on the pitting susceptibility of SS304L under full immersion and cyclic RH conditions. The results of this study are discussed in terms of potential canister degradation.

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