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Repassivation Behavior of A Ni-22% Cr-13% Mo-3.8% Fe-2.8% W Alloy in Chloride-Containing Solutions With and Without Sulfur at 22 and 60 °C

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To evaluate the susceptibility to sulfur-enhanced corrosion, repassivation behavior of Alloy 22 (Ni-22% Cr-13% Mo-3.8% Fe-2.8% W) was investigated in chloride-containing solutions with and without sulfur at temperatures of 22 and 60 °C [72 and 140 °F] using a scratch technique. The effects of applied potential and sulfur addition on repassivation of Alloy 22 were evaluated by measuring changes in current over time. All cases showed that once the passive film was mechanically disrupted by scratching, the anodic current increased abruptly to the peak current and thereafter decreased as repassivation occurred. As the anodic potential increased from −0.1 to 0.5 V_{SCE} in 0.5 M NaCl at 22 °C [72 °F], the peak current increased proportionally. The addition of 0.01 M Na_2S yielded nearly identical results as the sulfur-free cases in terms of repassivation rate and current charges during repassivation. However, an increase of the concentration to 0.1 M Na_2S or an increase of temperature to 60 °C [140 °F] causes a decrease of the peak current. In simulated concentrated water containing 0.01 M Na_2S, Alloy 22 repassivation was observed to commence immediately after scratching. Test results indicate that Alloy 22 can repassivate in a relatively short period in the sulfur-containing solution.