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Effect of thiosulfate on the SCC behavior of carbon steel welds exposed to concrete pore water under anoxic conditions

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The Supercontainer (SC) is the reference concept for the post-conditioning of vitrified high-level nuclear waste and spent fuel in Belgium. It comprises a prefabricated concrete buffer that completely surrounds a carbon steel overpack. Welding is being considered as a final closure technique of the carbon steel overpack in order to ensure its water tightness. Welding is known to induce residual stresses near the weld zone, which may lead to an increased susceptibility to stress corrosion cracking (SCC). In this study, slow strain rate tests were conducted to study the SCC behavior of plain and welded P355 QL2 grade carbon steel exposed to an artificial concrete pore water solution that is representative for the SC concrete buffer environment. The tests were performed at 140°C, a constant strain rate of $5 \times 10^{-7} \text{ s}^{-1}$ and at open circuit potential under anoxic conditions. The effect of thiosulfate on the SCC behavior was investigated up to levels of 5.35 mM $\text{S}_2\text{O}_3^{2-}$ (600 mg L⁻¹).

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