Stress corrosion cracking behavior at fusion boundary of cold worked 316LN stainless steel/Inconel 52M weld joint in simulated primary water environment

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Abstract Dissimilar metal weld joints (DMWJs) are considered weak points in nuclear power plants. Numerous factors. In 2021, flaw indications were detected using ultrasonic inspection in SI lines of the Civaux-1 in French, an N4 PWR, The most significant crack in Penly-1 involved the weld that was repaired twice during manufacturing [1]. Saukkonen et al. [2] reported that the highest degrees of plastic strain, equivalent to the condition of 10 – 20 % cold worked (CW), Applying CW to DMWJs can effectively simulate the service conditions of the repair welding area, thereby providing valuable stress corrosion cracking growth rate (SCCGR) data for evaluating their service performance. So far, there is limited data on the SCCGR near the FB of CW 316LN/52M welded joints in nuclear power plants. Moreover, SCCGR data for cold deformed welded joints in the fusion boundary (FB) under complex service conditions (such as dissolved oxygen, harm anions, temperature, etc.) are even scarcer. This highlights a critical research gap that needs to be addressed to better understand and mitigate stress corrosion cracking (SCC) in these environments.

This study investigated the microstructure of the FB for CW 316LN stainless steel/Inconel 52M weld joint (20%CW 316LN/52M-FB) was investigated. The FB region was subjected to SCCGR test in simulated primary water of pressurized water reactor using direct current potential drop technology. The results indicated that SCC occurred both along the FB and in the 316LN region. The propagation of secondary cracks was impeded in the Cr and Ni-rich 52M region. Under similar conditions, the

SCCGR of 20%CW 316LN/52M-FB was five to six times higher compared with 316L/52M-FB without CW.

Keywords Cold worked, 316LN/52M weld joint, Fusion boundary, Stress corrosion cracking.

Reference

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