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B. Alexandreanu, O. K. Chopra, and W. J. Shack

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William H. Cullen, Jr., NRC Project Manager

11. ABSTRACT (200 words or less)

In light water reactors (LWRs), vessel internal components made of nickel–base alloys are susceptible to environmentally assisted cracking. A better understanding of the causes and more effective mechanisms of this cracking may permit more accurate assessments of damage accumulation and requirements on inspection intervals. A program is under way at Argonne National Laboratory to evaluate the resistance of Ni alloys and their welds to environmentally assisted cracking in simulated LWR coolant environments. This report presents crack growth rate (CGR) results for the following nickel alloys tested in a simulated LWR environment: Alloy 600 removed from the Davis–Besse control rod drive mechanism nozzle #3, Alloy 182 from a J–groove weld nozzle #11 from Davis–Besse, and Alloys 182 and 82 from a hot–leg nozzle–to–pipe weld of the V.C. Summer reactor coolant system. The results from the present study are compared with the existing CGR data for Ni alloys to determine the relative susceptibility of these particular heats of material to environmentally enhanced cracking. Under cyclic loading, the Alloy 600 nozzle exhibited significant environmental enhancement, but little or no environmental enhancement was evident for the weld alloys from both Davis-Besse and V.C. Summer. Under constant load, the CGRs of the Alloy 600 nozzle are a factor of 4–8 higher than the median CGRs based on all the available data for Alloy 600 materials. This material exhibited predominantly intergranular fracture, even during precracking under cyclic loads. For both the Davis-Besse and V.C. Summer weld alloys, the CGRs under constant load are lower than those predicted by the disposition curve proposed for Alloy 182 weld metals.

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