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Crack Growth Rates of A182 and A82 Alloys from the V.C. Summer Reactor Vessel Nozzle-to-Pipe Weld

Bogdan Alexandreanu — Argonne National Laboratory, United States
Omesh Chopra — Argonne National Laboratory, United States
Willaim J. Shack — Argonne National Laboratory, United States

The Ni–base alloys used as construction material in light water reactors (LWRs) have experienced stress corrosion cracking (SCC). Although SCC of wrought Ni–base Alloy 600 has been observed in operating plants for many years, until recently, the weld metal Alloys 82 and 182 used with Alloy 600 environmentally assisted cracking has not been widely observed in the field. However, laboratory tests indicate that in PWR coolant environments, the SCC susceptibility of Alloy 182 may be greater than that of Alloy 600, and that of Alloy 82 may be comparable to Alloy 600. This paper presents crack growth rate (CGR) results for Alloys 182 and 82 from the reactor vessel nozzle–to–pipe from the V. C. Summer plant under both constant and cyclic load. The tests were conducted on ½–T compact tension specimens in a simulated PWR environment at 320°C. Crack extensions were measured by DC potential drop measurements. Characterization of the material microstructure and is described. The SCC growth rates are compared with the existing CGR data for Ni–alloy welds to evaluate the effects of alloy type, weld microstructure, and stress intensity factor K on CGRs. The cyclic CGRs for these alloys are compared with CGRs that are expected for Alloy 600 in air under the same mechanical loading conditions to obtain a qualitative understanding of the degree and range of conditions for significant environmental enhancement in growth rates. A detailed characterization of the fracture morphology is also presented.