

Sodium Hideout Study in an Open Tubesheet Crevice

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Abstract

In a locally restricted steam generator (SG) geometry, impurities in the bulk water can be concentrated by boiling process to extreme pH that may then accelerate the corrosion of tubing and adjacent materials. To mitigate the corrosion, the Molar Ratio Control technique is widely implemented with the EPRI initiative. In order to maximize its beneficial effect, the understanding of crevice processes needs to be advanced. To simulate a real SG tubesheet crevice high temperature/high pressure (HT/HP) crevice simulation system has been developed. Primary water with high flow rate flowed through the 3/4" tube and crevice section was made at the outside of the tube. The simulation apparatus was equipped with thermocouples and electrodes for the measurement of oxidation reduction potential (ORP) in crevice and bulk water. In an unpacked tubesheet crevice with 0.15 mm gap and 40 mm depth, axial temperature distribution and Pt potential vs. Ag/AgCl (Water) were measured with time. Also, to find crevice concentration from conductivity data AC impedance technique was used. Secondary pressure was maintained at 805±5 psi. Secondary solution composed of 50 ppm Na and 1.85 ppm H₂ was supplied with the flow rate of about 4 L/hr. NaOH concentration process in crevice was observed from temperature and potential data. Conductivity in crevice was measured intermittently but insufficient to show the concentration process. Experimental data showed a similar behavior compared with calculated results by MULTEQ[®]. From the boiling point elevation data crevice concentration factor was estimated as about 400 for ΔT=14 °C and about 2000 for ΔT=29 °C.