Experimental Simulation of SG Tubesheet Crevice Chemistry

Chi Bum Bahn, Si Hyoung Oh, Byung Gi Park, and Il Soon Hwang
Seoul National University
San 56-1, Shinlim-dong, Gwanak-gu, Seoul 151-742, Korea

In Hyoung Rhee
, Soonchunhyang University
San 53-1, Shinchang-myoun, Asan, Chungcheongnam-do 336-745, Korea

Uh Chul Kim, Jung Won Na
Korea Atomic Energy Research Institute
150 Dukjin-dong, Yusong-gu, Daejon 305-353, Korea

Abstract

In a locally restricted geometry on the secondary side of steam generator (SG) in a pressurized water reactor (PWR), impurities in bulk water can be concentrated by boiling process to extreme pH that may then accelerate the corrosion of tubing and adjacent materials. To simulate a real SG tubesheet crevice, a high temperature/high pressure (HT/HP) crevice simulation system was constructed. Primary water was pumped at a high flow rate through a 3/4" outer-diameter tubing and a crevice section was made on the outer diameter (OD) side of the tubing. The simulated crevice area was monitored with thermocouples and electrodes for the measurement of temperature and electrochemical corrosion potential (ECP), respectively, in the crevice as well as free span. A secondary solution composed of 50 ppm Na and 200 ppb hydrogen (H_2) was supplied at a flow rate of about 4 L/hr. In an open tubesheet crevice with 0.15 mm radial gap and 40 mm depth, axial distributions of temperature and ECP were measured as a function of time and available superheat. Sodium hydroxide (NaOH) concentration process in the crevice and the resultant evolution of crevice boiling regions were characterized from temperature and ECP data. Measured data for an open crevice showed a similar behavior to predictions by a thermodynamic equilibrium code. Magnetite-packed crevice had much longer time to reach a steady state than open crevice.