ELECTROCHEMICAL CORROSION POTENTIAL MEASUREMENT WITH A ROTATING CYLINDER ELECTRODE IN 288°C WATER

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Objectives: This study focuses on a description of the test apparatus and the effects of water flow velocity on the electrochemical corrosion potential (ECP) behavior of stainless steel in 288°C water under simulated BWR conditions.

Comments: The ECP of 316 stainless steel was measured by using the rotating cylinder electrode under simulated BWR water chemistry conditions. It was demonstrated that the rotating cylinder electrode (RCE) is useful for measuring the ECP under hydrodynamic conditions in 288°C water. Because of the practical limitation and undefined hydrodynamic conditions by the pipe loop and the paddle wheel, the RCE is useful for practical evaluation of the effect of flow velocity on the kinetics of electrochemical processes.

Remarks/Potential for dose limitation: It has been shown that IGSCC susceptibility can be markedly decreased if the ECP can be decreased below a critical value. ECP behavior is known to be controlled by the dissolved H_2, O_2, and H_2O_2 concentrations in the BWR coolant and subsequently mass transfer rates of these species play an important role on ECP. Therefore, an acceleration of the electrochemical reactions of H_2 and O_2 caused by hydrodynamic water flow is expected to alter ECP behavior of stainless steel under various water chemistry conditions. The preliminary data have shown that the increase of the water flow velocity accelerates the oxygen reduction rate under various dissolved oxygen conditions and subsequently results in a positive ECP shift.

References: Kim, Y.J, Lin, C.C., and Pathania, R., "Electrochemical Corrosion Potential Measurement With a Rotating Cylinder Electrode in 288°C Water," *Water Chemistry in Nuclear Reactor Systems 6*, Vol. 1, pp. 139-144, British Nuclear Energy Society, London, 1992.

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