

Electrochemical Potential (ECP) of Clean Heated Fuel Cladding Material and Structural SS under BWR Operating Conditions

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Abstract – *To preliminarily monitor the relative effect of advanced water chemistry measures on SS (Stainless Steel) structural material and fuel cladding in BWR environments, a number of experiments were performed using laboratory equipment (recirculation loop, autoclave with heated electrodes, reference electrodes, etc.). The simulation of the plant condition was accomplished without impurities or crud deposit contribution (clean surfaces). Subsequent testing, performed during 2007 and not yet cleared for release, considers the effect of combined complex BWR chemistries and crud deposition.*

The heated Zircalloy fuel-clad tubing was prepared to simulate heat transfer by internal heating at levels existing in BWR plants (70W/cm²). A platinum electrode was used to measure the redox potential of the electrolyte. A high-temperature Ag/AgCl electrode was used as a reference electrode. For comparison purposes, additional type SS347 electrode and unheated zirconium were used. The assembly was installed in a recirculation, one-liter autoclave. This report presents corrosion potential measurements performed under the following BWR water chemistry conditions (at 288°C fluid exit temperature, 86 bar with surface temperature of Zirconium hot finger at 296°C):

- *normal (inert) water conditions,*
 - *hydrogen injection in three steps from 0.68 ppm to 1.6 ppm,*
 - *oxygen injection in three steps from 2.4 ppm to 10 ppm*
- methanol 2 ppm and oxygen 2 ppm in a close loop (without methanol refreshing)*