Electrochemical Study of Corrosion Phenomena in Zirconium Alloys

LT Nicole M. Treeman, USN

Prof. Ronald G. Ballinger	Prof. Ronald M. Latanision
Thesis Supervisor	Thesis Reader

Shadow corrosion of zirconium alloy fuel cladding in boiling water reactor (BWR) environments, the phenomenon in which accelerated corrosion is experienced when the cladding surface is in the close proximity to other metals, and directly correlating to the distance of the water gap between the metals, has become a potentially life-limiting issue for BWR fuel. The limitations placed on the burn-up of uranium oxide fuel correlates to the amount of corrosion seen through a directly measurable oxide thickness on the waterside of the zirconium alloy cladding. Through analysis of the mechanisms potentially causing the shadow corrosion phenomenon, effective mitigation means can be developed leading to the ability to increase the allowable burn-up for uranium oxide fuel and lower associated fuel and nuclear waste disposal costs. The scope of this thesis was an experiment observing the electrochemical potential (ECP) and galvanic current created from pairing Inconel (X-750), platinum, and Zircalloy-2. Additionally, alternating current impedance (ACZ) was used to attempt characterization the corrosion films in-situ.