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Stephen S. Raiman, Gary S. Was

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ACCELERATED CORROSION AND OXIDE DISSOLUTION IN 316L STAINLESS STEEL IRRADIATED IN SITU IN HIGH TEMPERATURE WATER

*Stephen S. Raiman, Gary S. Was

University of Michigan: 2355 Bonisteel Boulevard, Ann Arbor, MI, 48109

**Corresponding Author: sraiman@umich.edu*

ABSTRACT

316L stainless steel samples were irradiated with a proton beam while simultaneously exposed to high temperature water with added hydrogen (320°C, 3 wppm H_2, neutral pH) to study the effect of radiation on stainless steel corrosion. Irradiated samples had thinner and more porous inner oxides with a lower chromium content when compared to unirradiated samples. Observations suggest that depletion of chromium from the inner oxide can be attributed to the dissolution of chromium-rich spinel oxides in irradiated water, leading to an accelerated rate of inner oxide dissolution. Sample areas which were not irradiated, but were exposed to the flow of irradiated water were also found to be porous and deficient in chromium, indicating that these phenomena can be attributed primarily to water radiolysis. A new empirical equation for oxide growth and dissolution is used to describe the observed changes in oxide thickness under irradiation. An experiment in which a stainless steel sample was exposed to high temperature