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# Characterization of Irradiated 309L Stainless Steel Cladding Produced by Laser Directed Energy Deposition

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In this work we characterize the radiation and corrosion behavior of a dissimilar metal weld fabricated by a laser directed energy deposition additive manufacturing technique. Novel metal additive manufacturing methods have the ability to fabricate and clad components used in light water reactors. These components may face several sources of degradation including mechanical wear, thermal stress, corrosive environments, and radiation damage. Quantifying the combined effects of irradiation on corrosion behavior is especially important for dissimilar metal welds, which are often locations for premature component failure. We fabricate dissimilar metal claddings of 309L stainless steel onto 1018 carbon steel and perform 1.5 MeV proton irradiation at 0.5 and 1.0 dpa to simulate the lifetime neutron radiation damage of a light water reactor pressure vessel. Samples are irradiated in cross-section, exposing the dissimilar metals, their interface, and the heat-affected zone. After irradiation, we perform localized corrosion testing with scanning-vibrating electrode technique in boric acid electrolytes to simulate corrosion in a light water reactor. Additionally, we explore radiation-induced material changes throughout the dissimilar metal couple with scanning electron microscopy, energy dispersive spectroscopy, transmission electron microscopy, and nanoindentation. Such localized methods are selected to correlate material property relationships on a small sample size (10 mm x 3 mm) with a limited proton irradiation depth.