N10. Protective Coatings For Radiation Control In Boiling Water Nuclear Power Reactors

Stainless-steel surfaces (316 nuclear grade) develop 60-Co-embedded oxide scales when exposed to a boiling water reactor (BWR) environment. Thin films such as Pd, Ni, Au, and Cr were found to drastically reduce the radioactive buildup. The films were prepared by vacuum evaporation and electrolysis deposition. The electrolysis coating consisted of a thin cathodically treated layer, followed by a nickel strike (about 1 μm) and an electrolysis layer (about 600 angstrom). The coated stainless-steel rods, when exposed to a simulated BWR environment, exhibited corrosion film growths ranging from large faceted grains (uncoated) and isolated islands of similar crystallites (Au coated) to extremely small nucleated growths (Pd, Ni coated). Also, it was found that chromium oxide films, which generally form a protective oxide on stainless steel, do not completely stop either the corrosion film growth or the associated radioactive buildup. The morphologies of the corrosion film growth were correlated with the relative 60-Co activity, and the substrate topography. The best coating to date was found to be a Pd thin film, 1000 angstrom thick, which reduced the radioactive buildup by a factor of about 13.

For more, see Rao., T.V., Vook, R.W., Meyer, W. and Wittwer, C., "Protective coatings for radiation control in boiling water nuclear power reactors," J. Vac. Sci. Technol. A 5(4):2701-5, 1987.