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Palladium Impedes Radionuclide Pick-Up in Steel

The γ-emitting isotope, ^{60}Co, is known to be the primary offender in causing radioactivity of reactor structural steels. This radionuclide readily incorporates into the various oxides that form on the out-of-core steel surfaces of nuclear reactors operating in coolant environments, at temperatures of approximately 280°C. Thus to lessen the build up of radiation in these structural materials there is a need to eliminate or reduce the incorporation of ^{60}Co.

Some extremely encouraging experimental results from North America have recently been reported following the exposure of various pre-treated austenitic 304 steels to simulated boiling water reactor and pressurised water reactor primary coolant conditions (1, 2). Two metallic films and nineteen pre-oxidation treatments were evaluated for their efficacy in reducing ^{60}Co contamination. Of these treatments, the deposition of palladium by an electroless technique proved to be particularly effective. Palladium, about 0.6 μm thick, deposited from a standard electroless plating bath closely followed the contours of the steel, and generally filled in major defects on the surface. This layer reduced the corrosion of the stainless steel and so impeded radionuclide pick-up.

Although amorphous nickel-phosphorus films performed reasonably well, it is pointed out that such a system has less attractive characteristics, due to the potential release of the γ-emitting ^{58}Co isotope from radioactivated nickel.

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