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Corrosion Assessment of Candidate Materials for the SHINE Subcritical Assembly Vessel and Components

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ABSTRACT

Laboratory corrosion testing of candidate alloys—including Zr-4 and Zr-2.5Nb representing the target solution vessel, and 316L, 2304, 304L, and 17-4 PH stainless steels representing process piping and balance-of-plant components—is underway in support of the proposed SHINE process to produce ^{99}Mo from low-enriched uranium. The testing utilizes depleted uranyl sulfate in various concentrations and incorporates a range of temperatures, excess sulfuric acid concentrations, and iodine additions. Testing has included static immersion of coupons (fully immersed and in vapor), galvanic tests featuring couples between a stainless steel and a zirconium-based alloy, U-bends (fully immersed and in vapor), slow-strain rate exposures, and electrochemical polarization as a function of rotating disk speed. Preliminary testing has also included encapsulated exposures in a spent fuel pool to generate active gamma-radiolysis conditions. Results to date indicate the candidate alloys are quite resistant to general and localized corrosion under a wide range of exposure conditions.

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