

Measuring Radiolytic- and Fission-Gas Generation in an Aqueous Uranium-Sulfate Target Solution in Accelerator-Based Mo-99 Production

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ABSTRACT

Irradiation of aqueous uranyl sulfate solutions and fissioning of U-235 evolve a variety of gases that need to be characterized to ensure safe and efficient operation of these highly dynamic systems. The particular gases of interest are water vapor, hydrogen, oxygen, iodine and noble gases. The micro- and mini-SHINE experiments being performed in the LINAC Accelerator Facility at Argonne have been used to study the production of these gases in water and acidic sodium-bisulfate and uranyl-sulfate solutions. The real-time quantities of radiolytic gas produced from neutrons, high-energy x-rays, and fission products have been sampled using an in-line analysis loop. Samples to measure fission-gas release are captured throughout the run for later gamma analysis. Three experimental setups have been tested: a closed solution capsule, a once-through system, and a closed-loop system. The results from these experiments provide key insights to designing a production-scale system.