

Abstract
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Radiolysis of Moisture Sorbed on Neptunium Oxides

A. S. Icenhour, R. M. Wham, R. R. Brunson, and L. M. Toth
Nuclear Science and Technology Division
Oak Ridge National Laboratory
P.O. Box 2008
Oak Ridge, Tennessee 37831-6221
865-576-5315, icenhouras@ornl.gov

Neptunium-237 that is currently stored as a nitrate solution at the Savannah River Site (SRS) will be converted to NpO_2 and then shipped to the Y-12 National Security Complex in Oak Ridge for interim storage. This material will serve as feedstock for the ^{238}Pu production program, and periodic shipments will be made to the Oak Ridge National Laboratory (ORNL) for target fabrication. The establishment of criteria for safe storage of this material (specifically, the moisture content) requires an understanding of the radiolysis of moisture that is sorbed on the oxides. An experimental program was undertaken at ORNL to evaluate the effects of radiolysis on moisture sorbed on NpO_2 . Neptunium oxide samples were exposed to a known humidity to measure the rate and amount of water uptake. Gamma and alpha radiolysis experiments were conducted on samples ranging from essentially dry to those with moisture contents up to 8 wt %. The gamma radiolysis experiments used a ^{60}Co source ($\sim 10^5$ rad/h) and spent nuclear fuel elements from the High Flux Isotope Reactor (10^7 – 10^8 rad/h). For the alpha radiolysis experiments, samples of NpO_2 were spiked with ~ 7000 ppm ^{244}Cm as a surrogate for the expected ~ 500 ppm ^{238}Pu in the SRS material. Pressure monitoring and gas analyses provided measures of the gas production and consumption. This paper provides an overview of the experiments and describes the results.