

Micro-X-ray Fluorescence Characterization of Plutonium-Beryllium Neutron Sources

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Plutonium-beryllium (PuBe) alloy (PuBe₁₃) is a useful neutron source for nuclear, medical, industrial, and other applications. In this work PuBe was examined for elemental impurities using micro-X-ray fluorescence (MXRF). Due to the hazardous nature of this material, careful sample preparation was required. Plutonium-beryllium is not just a neutron emitter; the presence of both Pu and Be makes it particularly hazardous to handle. Working in a radiological containment box, the samples were sealed inside plastic XRF cups using Mylar film. For powder samples, the cups were further sealed inside a plastic bag and analyzed through the Mylar and bag. Thus, low Z elemental analysis was not possible, but transition metal spatial distributions were analyzed.

A lathe was used to cut open stainless steel containers housing two PuBe powders. Because of concern the PuBe could have been contaminated with steel particles during the lathe operation, MXRF was used to look for the presence of steel particles. A minor amount of steel particles appear to have been present in the powder based upon detection of iron, chromium, and nickel co-located in these particles, but these elements were not detected in the majority of the PuBe material analyzed. Large PuBe chunks from a different neutron source were also examined for impurities using MXRF. The results from this sample will be discussed along with the powder sample results.