

Hot Potato: Characterising Pu particles from Maralinga, Australia

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The high-energy release of plutonium (Pu) from a nuclear accident or weapon detonation results in its wide dispersion in the form of μm -sized, highly radioactive ‘hot’ particles that persist in soils. We characterized the composition and textures of particles resulting from historical nuclear testing in Maralinga, Australia, from the micro- to the nano- scales, using a combination of synchrotron μXANES , μEXAFS , μXRD , μXRF , and fluorescence tomography combined with SEM. The hot particles show remarkably different physical/chemical characteristics. Pu and U are distributed relatively homogeneously in “Potatohead”, and heterogeneously in “Bruce” (Figure 1). Pu exists as Pu(IV) in Potatohead, while the average oxidation state of Pu is $<\text{IV}$ in Bruce; with a mix of U(IV/VI) in both. These particles originated from above ground, most likely subcritical tests, so their speciation may be different than that occurring from separations, research wastes or releases from reactors. The particles consist mainly of Al, Fe and Pb, materials from the bomb casing and/or test featherbeds.

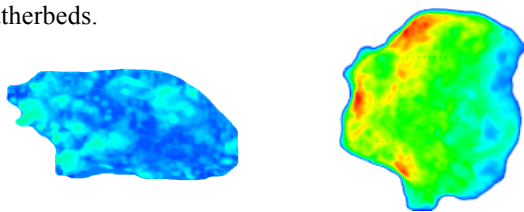


Figure 1: SXRf image of “Bruce” (left) highlighting the U/Pu variation within the particle, the lighter areas having more U and SXRf image of Pu distribution in “Potatohead” (right).