

Supporting Information

Production of Mixed Element Actinide Reference Particulates to Support Nuclear Safeguards using THESEUS, an Aerosol-based Particulate Synthetic Methodology

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Estimation of the Particulates' Material Density

Estimates of the generated particulates material densities were generated through the reconciliation of the particles' geometric mean as measured by aerodynamic and automated SEM measurements. The mean geometric aerodynamic diameter was adjusted to match the mean geometric aerodynamic diameter obtained by SEM using an inverse square relationship with the density as shown in equation 1.

$$d_{g,SEM} = \frac{d_{g,aero}}{\sqrt{\rho}} \quad (1)$$

Equation 1 can be rearranged to solve for density, shown in Equation 2.

$$\rho = \left(\frac{d_{g,aero}}{d_{g,SEM}} \right)^2 \quad (2)$$

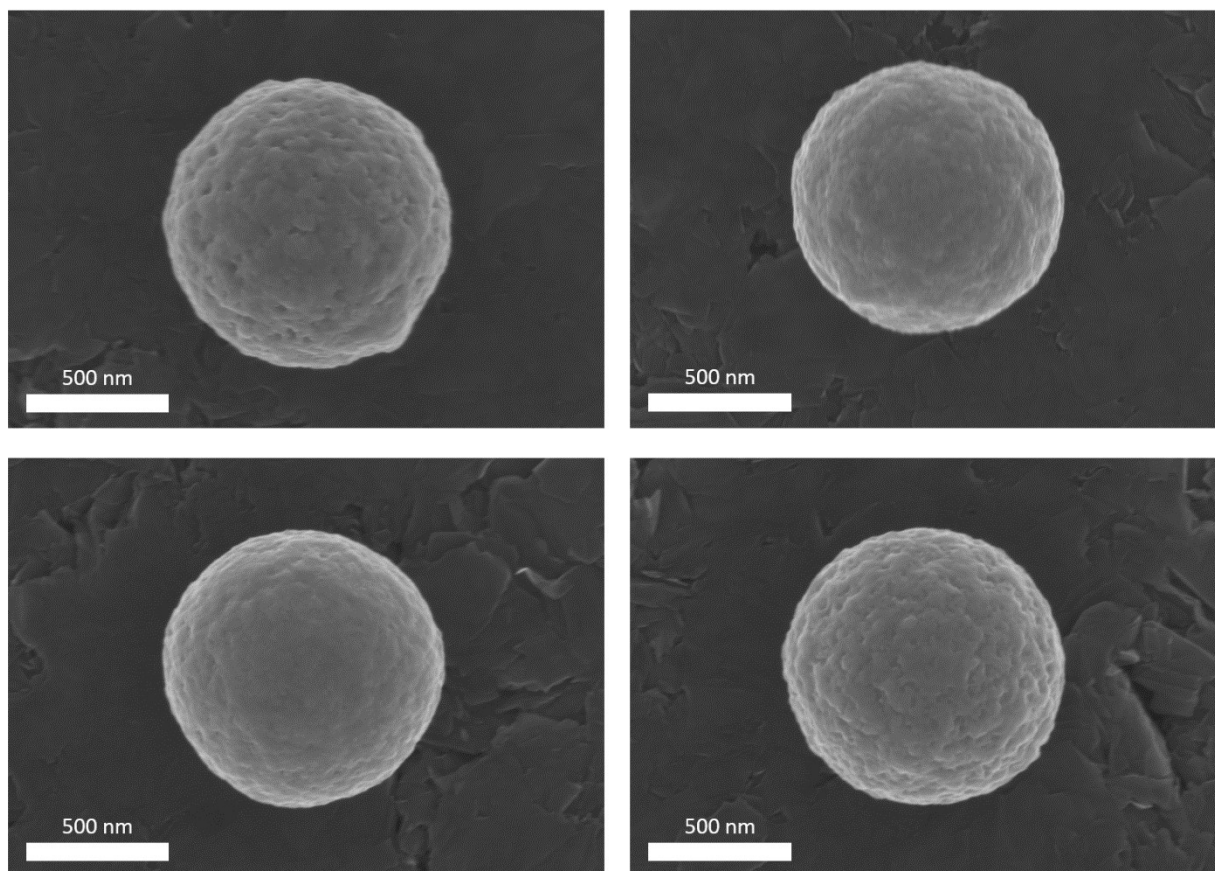


Fig. S1 Exemplar uranium oxide particulates.

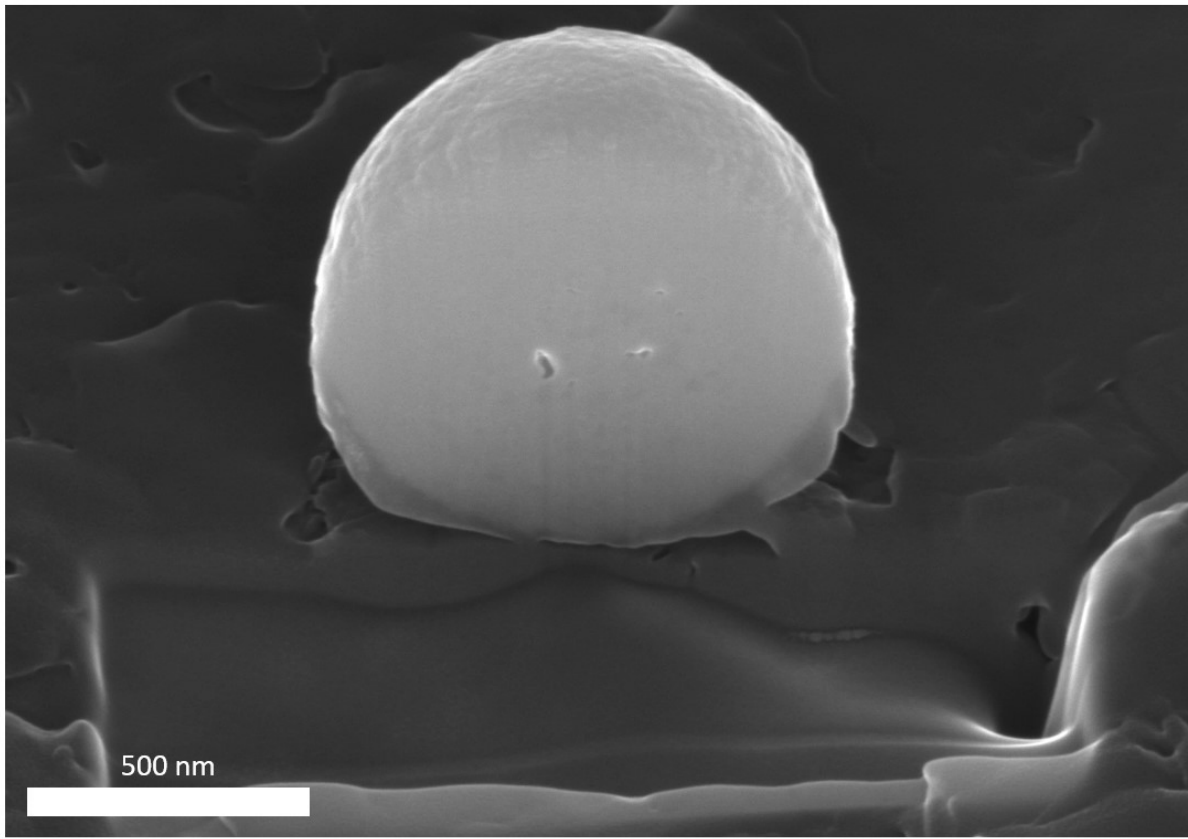


Fig. S2 Internal morphology of an exemplar uranium oxide particulate, obtained by FIB-SEM.

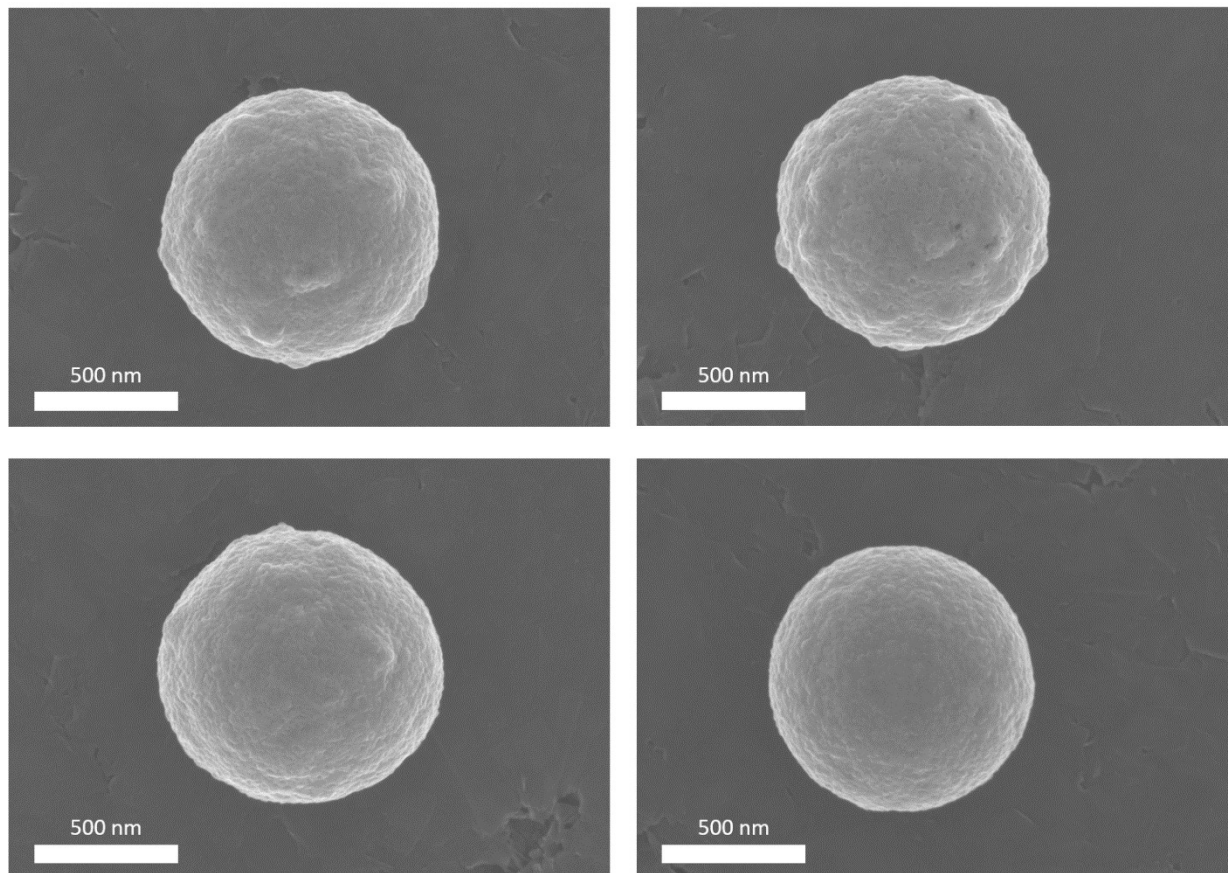


Fig. S3 Exemplar particulates of 1% Th/U ratio.

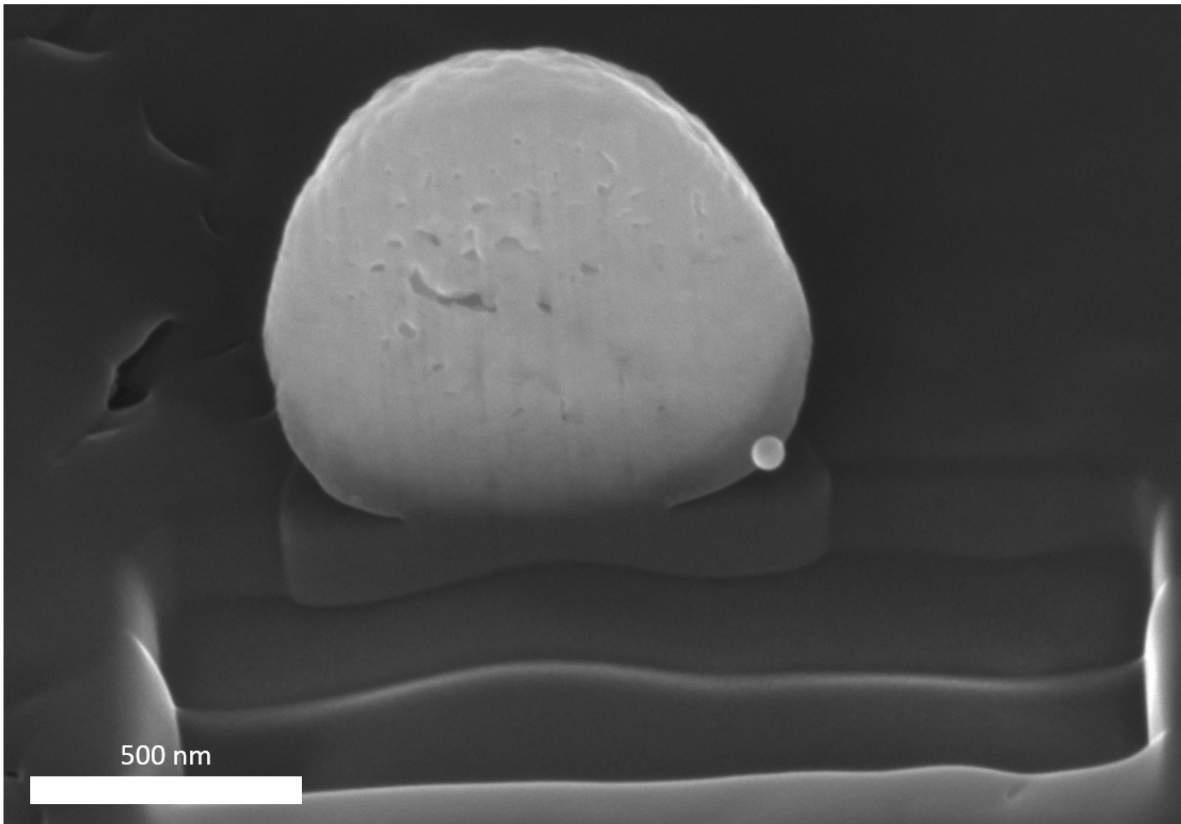


Fig. S4 Internal morphology of an exemplar 1% Th/U particulate, obtained by FIB-SEM.

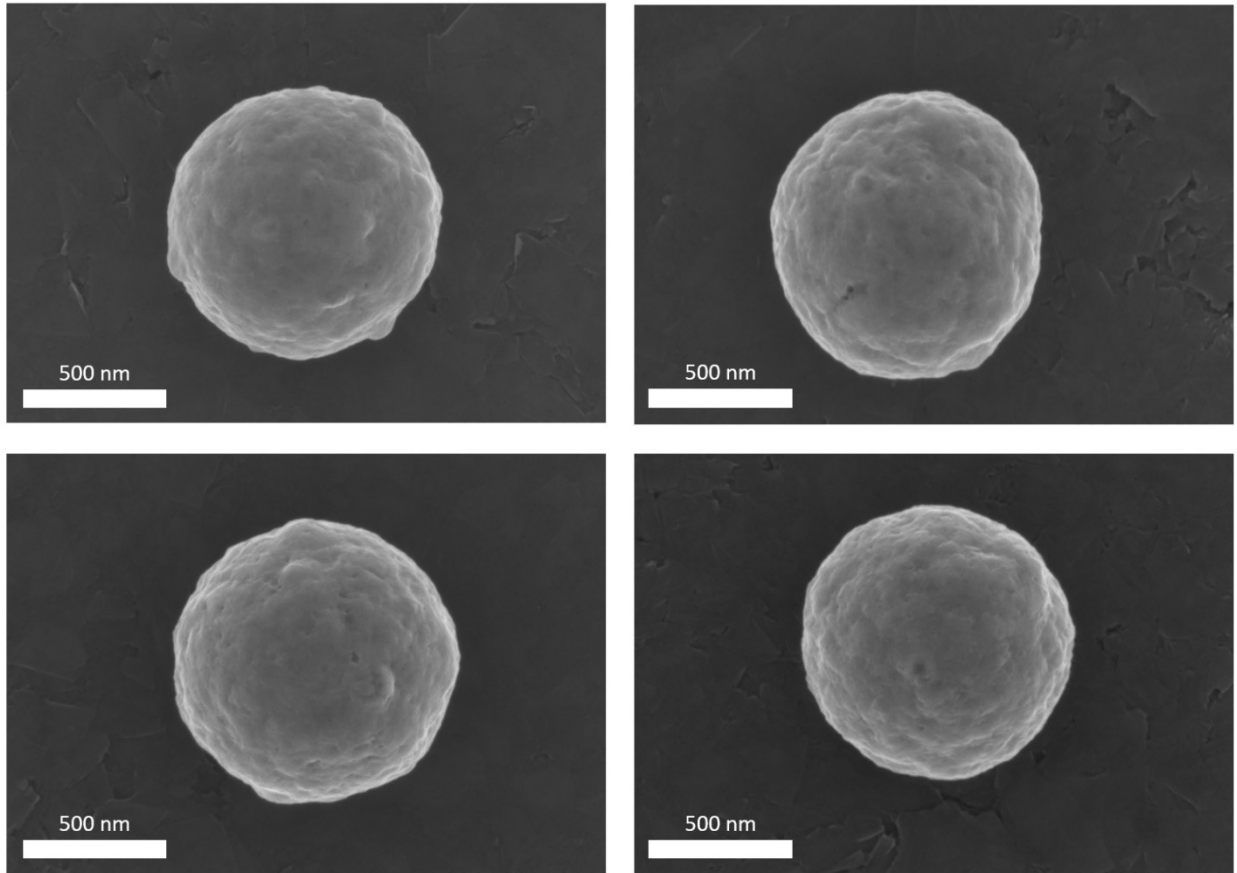


Fig. S5 Exemplar particulates of 10% Th/U ratio.

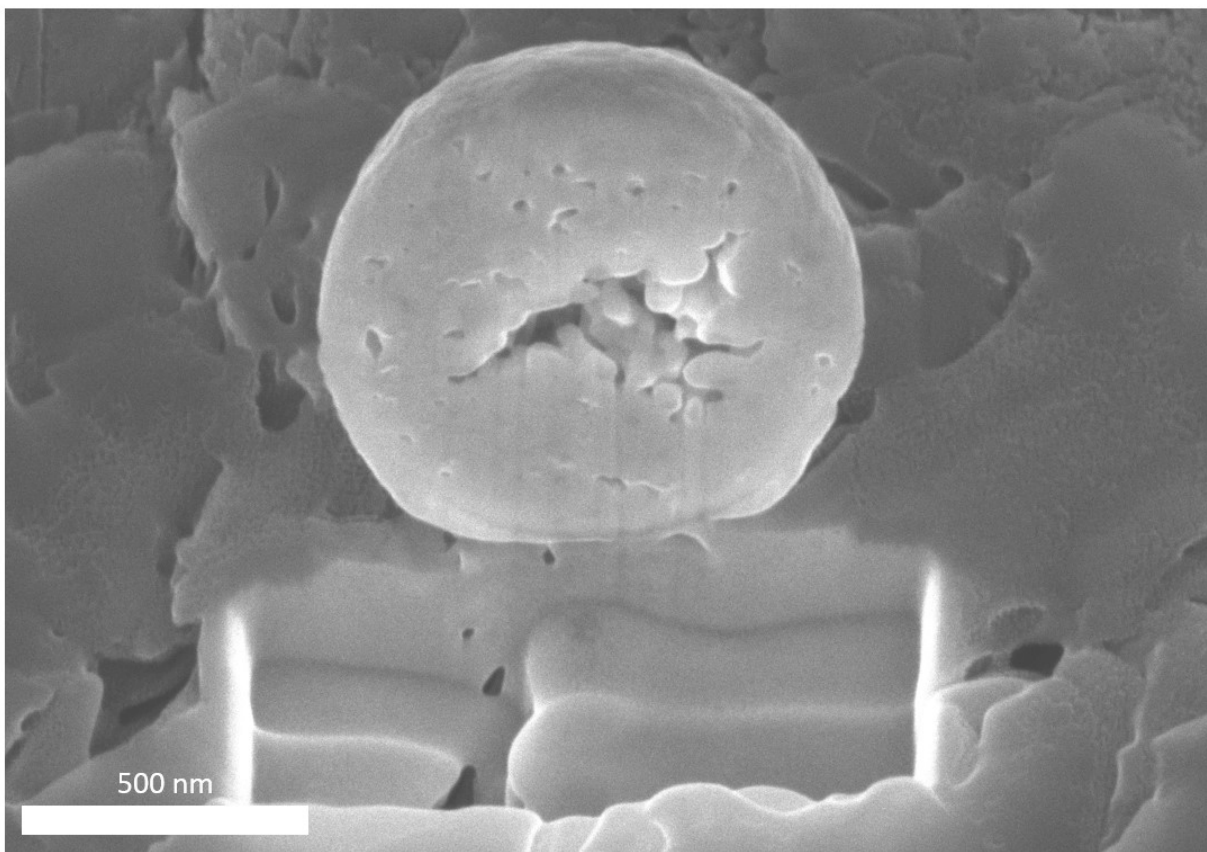


Fig. S6 Internal morphology of an exemplar 10% Th/U particulate, obtained by FIB-SEM.

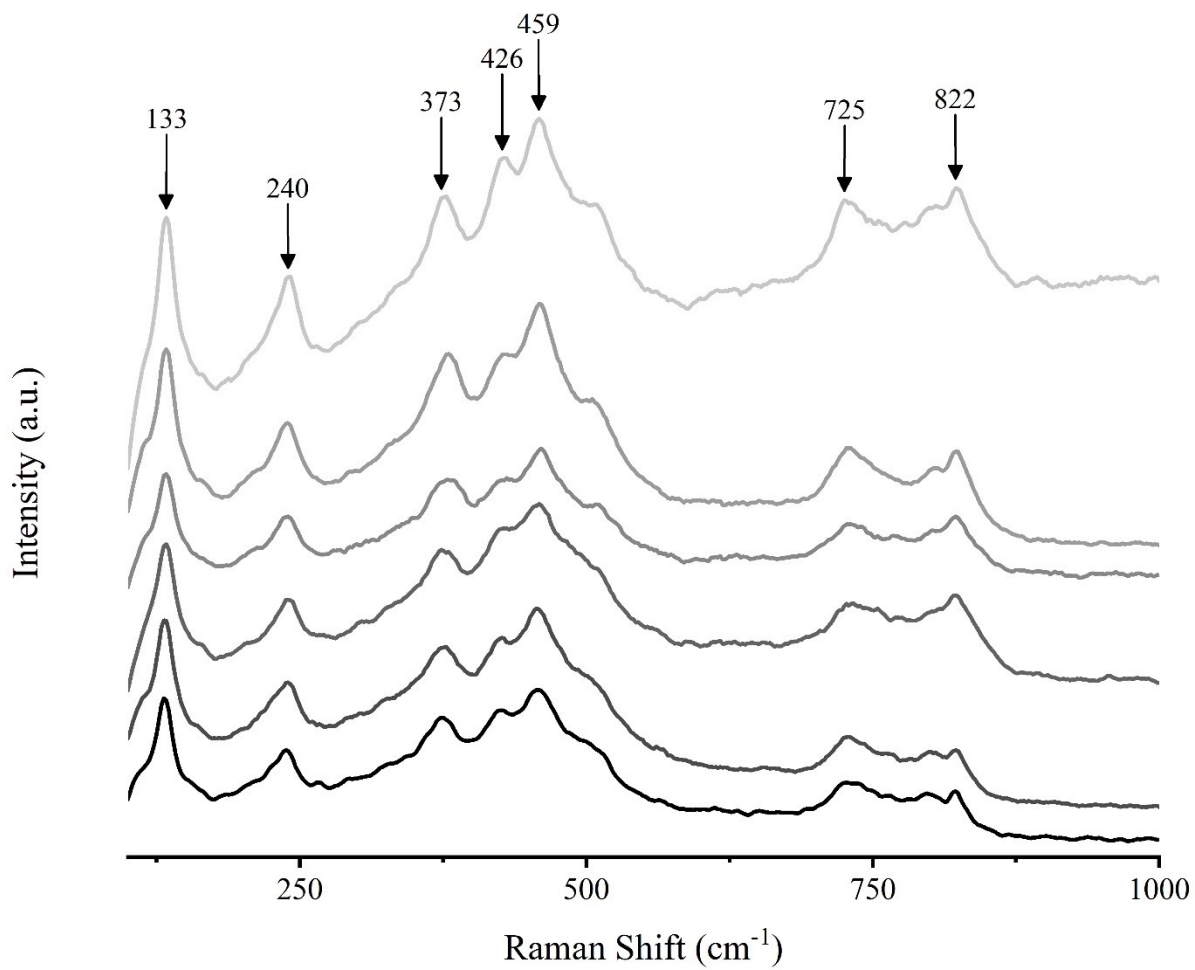


Fig. S7 Representative Raman spectra of uranium oxide particles synthesized with 600° C calcination temperatures. Spectra were acquired with a Renishaw InVia Reflex Confocal Raman spectrometer and 514 nm laser.

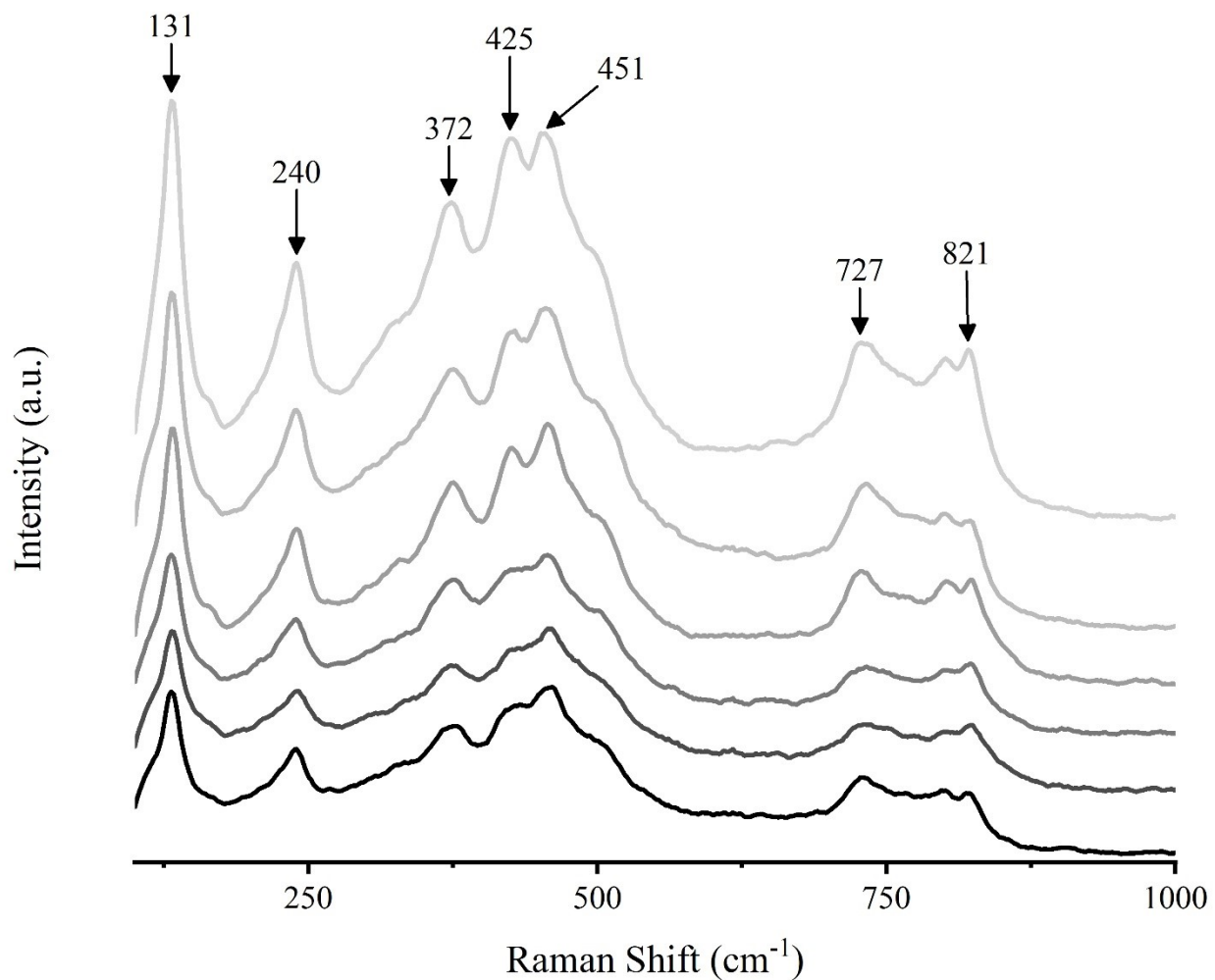


Fig. S8 Representative Raman spectra of 1% thorium oxide/uranium oxide particles synthesized with 600 °C calcination temperatures. Spectra were acquired with a Renishaw InVia Reflex Confocal Raman spectrometer and 514 nm laser.

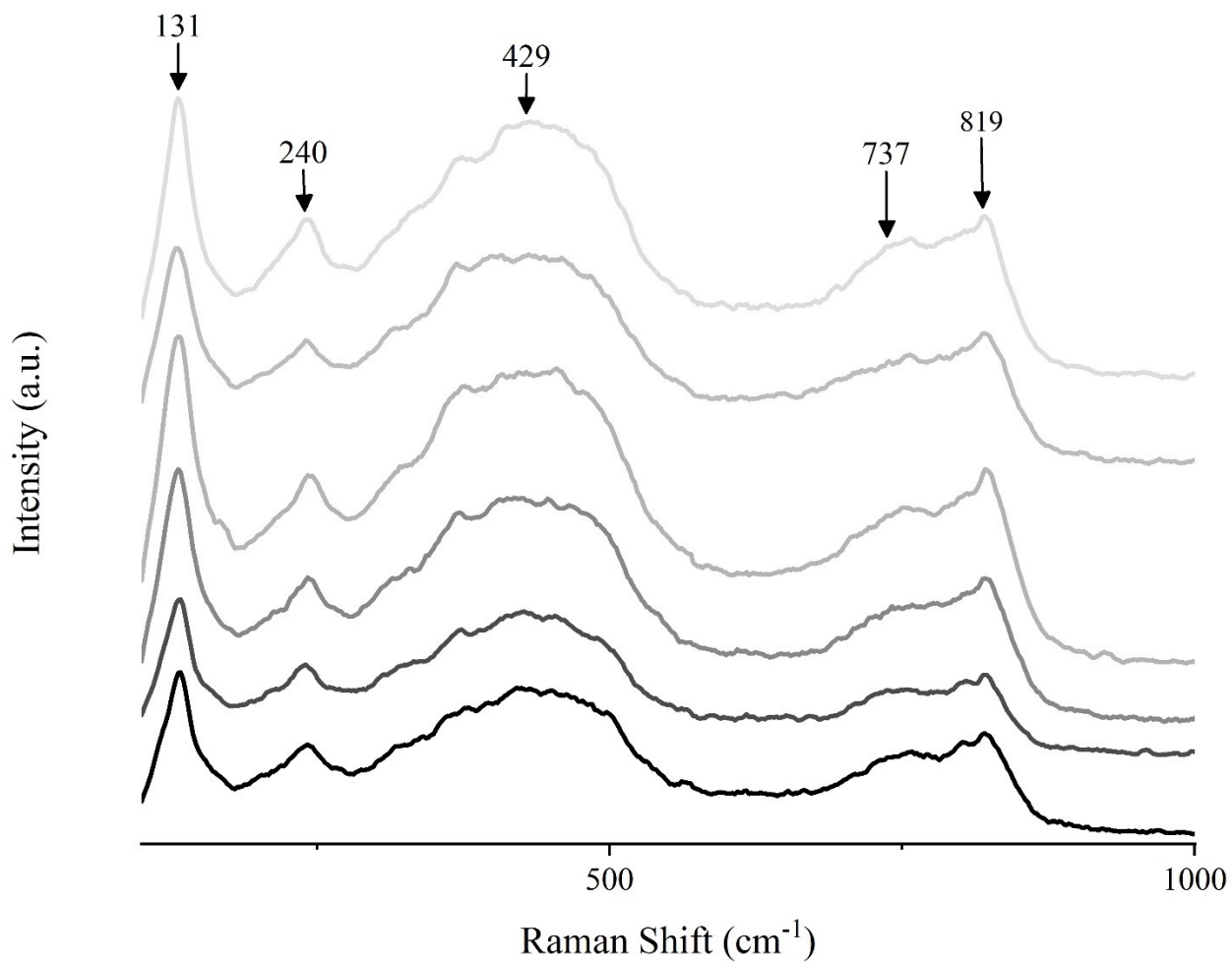


Fig. S9 Representative Raman spectra of 10% thorium oxide/uranium oxide particles synthesized with 600 °C calcination temperatures. Spectra were acquired with a Renishaw InVia Reflex Confocal Raman spectrometer and 514 nm laser.