Fabrication and properties of advanced urania fuel

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The search for fuel materials with superior properties to the current fuel systems has led to research on advanced UO_2 fuel candidates. Composite fuel ceramics are expected to improve the in-reactor performance by enhancing thermal conductivity as well as fission product retention. This study presents insights into fabrication routes using a sol-gel feedstock to obtain composite as well as metal oxide doped ceramic fuels. Diverse blending techniques resulted in different microstructures of the ceramics consequently resulting in different thermal properties of the nuclear fuel candidates. The addition of 10 vol% Molybdenum increased the thermal conductivity of UO_2 by 30%. The dopant particle size plays a key role in the enhancement of thermal conductivity with smaller particle sizes being favorable over larger ones. Multiple additive urania ceramics (e.g. Mo, Cr, Al) will be fabricated to look for correlations between the various additives regarding final properties of the fuel ceramics.

Characterization and comparison of different fabrication routes will identify the additive's role and ultimately allow for ehanced fuel design.