# Mesoscale modeling of the mechanical response of $UO_2$ microstructures

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Nuclear fuel pins in service experience one of the most complicated environment a structural material can hope for. The ability to adequately simulate the response of their microstructure and change in their mechanical response in such an environment is crucial to predictive models for safety and performance evaluation of nuclear reactors.

As part of team effort lead by Sandia to simulate the transient response of a TRU-fuel pin until clad failure, this talk will focus on the development and implementation of the mechanical response of uranium dioxide microstructure into Sandia's Material Point Method code MPALE. A crystal plasticity model was implemented for predicting the microstructural response. This computational model explicitly addresses the effects of microstructure by including realistic topological information (grain morphology, crystallography, grain size distribution), while a number of key physical characteristics are taken into account at the grain level (slip systems, crystallographic anisotropy, grain boundaries) to represent the elastoplastic response of $UO_2$. The predicted stress-strain response will be compared against available experimental data to illustrate the limitations of the present model and will be used as a starting point to discuss needed improvements.