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Framework for Mesoscale Simulation of Microstructural Evolution of Nuclear Fuels using Potts Kinetic Monte Carlo Methods.

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The Potts kinetic Monte Carlo (kMC) model is a particle-based, statistical mechanical method that has been used extensively to simulate many types of microstructural evolution processes. It is highly developed, extensively studied and applied, and well suited for simulation of fuels microstructural evolution during service. In this presentation, we will review the kMC model, demonstrate its utility for simulation of microstructural evolution of nuclear fuels and also demonstrate how kMC simulations can be used to obtain constitutive models for use in existing fuel performance codes. In particular, we will demonstrate the kMC model for simulation of fission gas formation and transport, swelling, formation of the high burn-up rim structure and evolution in temperature gradients.