

Ceramic Waste Form Design and Degradation: Mechanistic Understandings

Jie Lian

Department of Mechanical, Aerospace & Nuclear Engineering

Rensselaer Polytechnic Institute

Effective management of short-lived Cs-137 and Sr-99 radionuclides as the major heat generators and long-lived highly volatile I-129 and Cl-36 is critical for the sustainable development of nuclear energy systems. This talk discusses the recent development of advanced ceramic waste forms for critical radionuclides I, Cs and Cl and their long term performance. Advanced technologies such as spark plasma sintering are used to incorporate and consolidate the critical radionuclides into the dense ceramic waste forms. The thermal stability of the designed waste forms and their chemical durability as evaluated by water dissolution are conducted to achieve mechanistic understanding of waste form performance. In-situ synchrotron X-ray diffraction and environmental scanning electron microscopy observations are also performed to understand the phase transformation and dissolution behaviors. The impacts and implication of the designed ceramic waste forms on effective management of environmental wastes, particularly highly volatile iodine and chlorine, are further highlighted.