Actinide XAS 2014



Contribution ID: 46 Type: Oral

Monazite as promising candidates for nuclear waste management: Structural characterization by X-ray Absorption Spectroscopy

Wednesday 21 May 2014 16:50 (25 minutes)

Minor actinides such as Np, Am, and Cm contribute a major part of the heat load and radiotoxicity of spent nuclear fuel. Their separation and incorporation into stable ceramic phases may provide a route for their safe storage in deep-geological repositories or for their transmutation to short-lived nuclides. Natural monazites, early-lanthanide phosphate minerals of old age, contain up to 27 wt % UO2 + ThO2, demonstrating thereby a high incorporation capacity, high chemical durability and high resistance to radiation damage. Therefore, monazite-type ceramics are promising candidates for the long-term incorporation of minor actinides. The aim of this work is to reveal the structural changes of LaPO4 monazite induced by the incorporation of europium, an analogue for trivalent actinides. La1-xEuxPO4 monazite solid-solutions with x from 0.2 to 1.0 were synthesized and characterized by Eu L3-edge and La L1-edge, extended X-ray absorption fine-structure (EXAFS) spectroscopy at the Rossendorf Beamline (ESRF, France). Structural refinement of X-ray diffraction data showed a Vegard-like behavior of metal-oxygen and metal-metal distances, i.e. a linear decrease of these distances with increasing Eu content. In contrast, EXAFS analysis revealed that only the La-O distances in the first coordination shell and the first metal-metal distances decrease according to Vegard's law, while the Eu-O local coordination remains unchanged. These new EXAFS results provide important insight into the structural basis of the ideality and therefore stability of monazite solid-solutions; they will be used in the future to develop the thermodynamic constants needed for long-term stability predictions.

Primary author: Dr LOZANO-RODRIGUEZ, M. Janeth (1) HZDR, Institute of Resource Ecology, 01314 Dresden, Germany; (2) The Rossendorf Beamline at ESRF, CS 40220, 38043, Grenoble, CEDEX 9, France)

Co-authors: Dr SCHEINOST, Andreas C. (HZDR, Institute of Resource Ecology, 01314 Dresden, Germany; (2) The Rossendorf Beamline at ESRF, CS 40220, 38043, Grenoble, CEDEX 9, France); Dr NEUMEIER, Stefan (Institute of Energy and Climate Research, Nuclear Waste Management and Reactor Safety (IEK-6), Forschungszentrum Jülich GmbH, 52425 Jülich, Germany); Ms ARINICHEVA, Yulia (Institute of Energy and Climate Research, Nuclear Waste Management and Reactor Safety (IEK-6), Forschungszentrum Jülich GmbH, 52425 Jülich, Germany)

Presenter: Dr LOZANO-RODRIGUEZ, M. Janeth (1) HZDR, Institute of Resource Ecology, 01314 Dresden, Germany; (2) The Rossendorf Beamline at ESRF, CS 40220, 38043, Grenoble, CEDEX 9, France)

Session Classification: Actinides in Environmental and Life Sciences

Track Classification: Actinides in Environmental and Life Sciences