



Contribution ID: 48

Type: not specified

In-Pile Experiment Development to Investigate Transient Irradiation Performance of Fast Reactor Fuels at TREAT

Wednesday 6 November 2019 09:40 (20 minutes)

Transient irradiation testing of fast reactor fuels has been a major emphasis of several historical programs supporting both oxide and metal fuels for sodium-cooled fast reactors. These programs have been executed at several test facilities around the world, though today, very few remaining facilities exist capable to perform such studies. The purpose of these programs is to understand and establish fuel performance limits under anticipated off-normal, design basis, and beyond design basis accident conditions. The recent restart of the Transient Reactor Test (TREAT) Facility in the U.S. has provided unique capability and established renewed efforts to study advanced fuels under transient conditions. While water testing is already underway, test designs are rapidly maturing to support testing of advanced liquid metal cooled fast reactor fuels. These test designs include a liquid sodium capsule and a flowing liquid sodium loop. Detailed design efforts are underway to provide flexible testing environments that include advanced instrumentation to quantify fuel performance in a manner never previously performed. Nominally the experimental devices will support metal and oxide fuels for sodium-cooled faster reactors with logical extension to other fuel designs as needed. In the U.S., test plans for metal fuels are maturing to extend the existing fuel performance database and provide opportunity to evaluate novel fuel designs. These tests are also designed to leverage a large inventory of irradiated fuel pins from the Experimental Breeder Reactor (EBR)-II and Fast Flux Test Facility (FFTF) s that remain in storage on the INL site (both metal and oxide forms). This presentation will provide a detailed overview of the planned program and current status of test design and predictions for fuel performance.

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Session Classification: Session 5