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USHPRR MP-2 FactSheet

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Photo courtesy of BWXT

Miniplate-2 Experiment

Qualifying U-10Mo fuel for research reactors

Mini-plate capsule loading (above)

HIGHLIGHTS

The Miniplate-2 (MP-2) experiment will be the backbone experiment of the U-10Mo fuel qualification package. The extensive experiment will measure fuel properties and performance over and above the operating ranges of three U.S. High Performance Research Reactors (USHPRR) and provide data to support future irradiation for reactor licensing. Additional irradiation campaigns, shown in Figure 1, will test full-size plates and fuel elements to show the effect on properties and performance when test specimens are scaled up from mini-plates to elements.

OBJECTIVES

MP-2 will demonstrate the fuel performance and measure properties for the U-10Mo Monolithic fuel system, see Figure 2, for intermediate and bounding conditions of four USHPRRs. Five mini-plate geometries representative of bounding plates for the Massachusetts Institute of Technology Reactor (MITR), Missouri University Research Reactor (MURR), and the National Bureau of Standards Research Reactor (NBSR), all of which are licensed by the Nuclear Regulatory Commission (NRC), as well as the Advanced Test Reactor (ATR) are used. Each mini-plate geometry is tested to multiple power levels and fission densities. Replicate samples are required for various post-irradiation examination tests at each test condition and geometry.

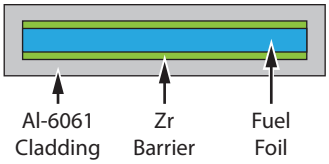

Figure 2. *Schematic cross-section of U-10Mo Monolithic Fuel.*

DESIGN OF EXPERIMENT

MP-2 will utilize six positions, as shown in Figure 3, in the ATR reactor at Idaho National Laboratory. Small I-21 and I-24 positions will be used to irradiated specimens at low powers, Large B-9, B-11, and B-12 positions will irradiate

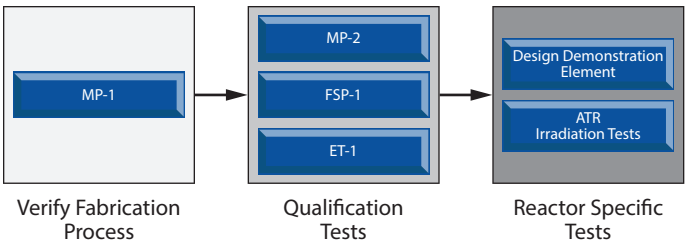

Figure 1. *Irradiation plans for USHPRR conversion.*

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specimens at mid-power levels, and the South Flux Trap (SFT) will be used to reach high powers. Capsules will be irradiated for varying lengths of time, up to seven cycles, as illustrated in Figure 4. A total of 201 fueled mini-plates in 66 capsules will be irradiated and then will undergo post-irradiation examinations at INL's Materials and Fuels Complex.

OUTCOMES

The extensive MP-2 test matrix will result in fuel performance and properties that have been demonstrated and measured over the entire reactor operating conditions for the NRC reactors, as shown in Figure 5. Additional data will be needed from future irradiations to bound the operation of ATR. The test will be carried out under the direction of the USHPRR Fuel Qualification (FQ) Pillar under the auspices of the U.S. National Nuclear Security Administration (NNSA) Office of Material Management and Minimization (M3). Data will be used to support the application to the U.S. Nuclear Regulatory Commission (NRC) for qualification of the U-10Mo fuel system.

STATUS

- Design is in the final stages. Verification of the final design will occur in FY 2021.
- Fabrication of nonfuel irradiation hardware will occur in FY 2020-2021. Fuel plates will be fabricated at the commercial fabricator, BWXT, starting in FY 2021.
- Irradiation testing is scheduled to begin in FY 2022.

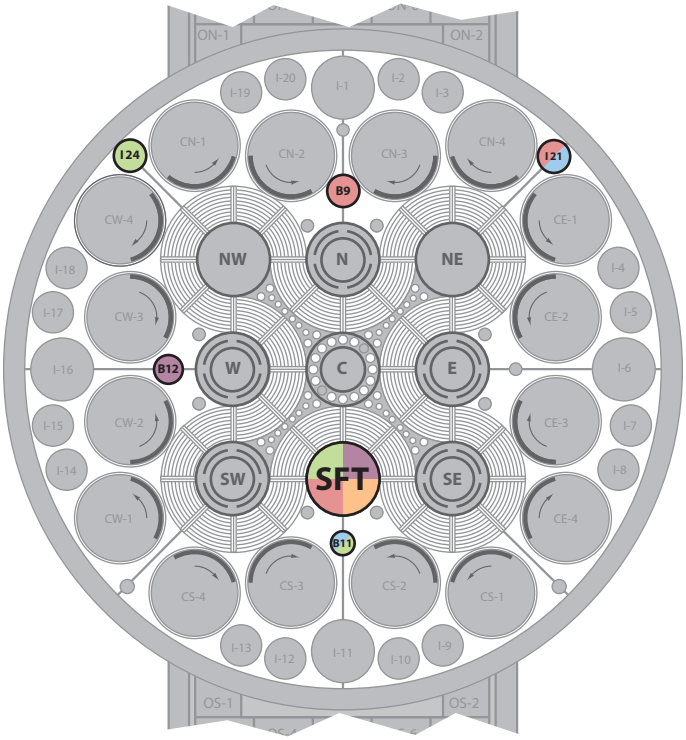

Figure 3. ATR cross-section showing MP-2 experiment locations for different geometries.

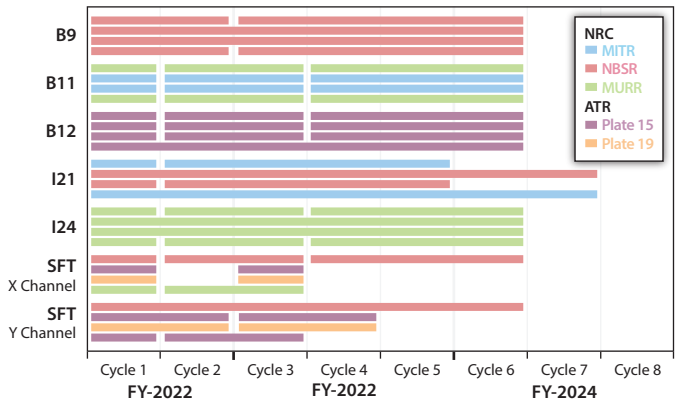

Figure 4. MP-2 irradiation schedule.

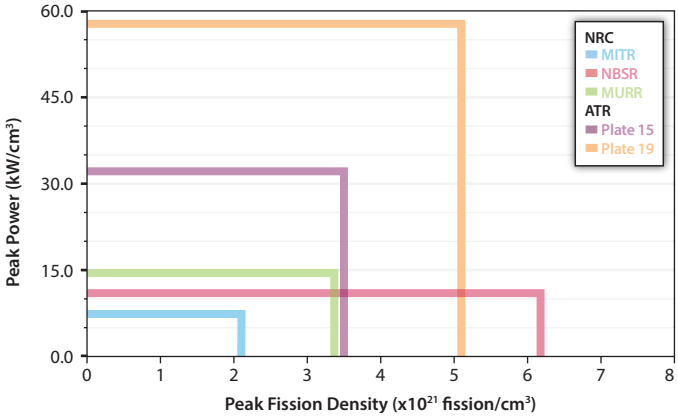

Figure 5. Operating envelope of NRC regulated reactors, which will be covered by the MP-2 experiment, and ATR.

FOR MORE INFORMATION

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