

Advanced Test Reactor National Scientific User Facility (ATR NSUF) Monthly Report December 2014

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Monthly Report

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Highlights

- PNNL has completed sectioning of the U.C. Berkeley hydride fuel rodlet 1 (highest burn-up) and is currently polishing samples in preparation for optical metallography.
- A disk was successfully sectioned from rodlet 1 at the location of the internal thermocouple tip as desired. The transition from annular pellet to solid pellet is verified by the eutectic-filled inner cavity located on the back face of this disk (top left) and the solid front face (bottom left). Preliminary low-resolution images indicate interesting sample characteristics in the eutectic surrounding the rodlet at the location of the outer thermocouple tip (right). This sample has been potted and is currently being polished for high-resolution optical microscopy and subsequent SEM analysis. *(See images.)*



Major Accomplishments/Activities

- The preliminary form of the Nuclear Energy Infrastructure Database (NEID) has been completed. The database contains information from 105 institutions; including 76 universities, 21 federal facilities and eight commercial sites. These institutions house 356 R&D facilities (laboratories) with 743 instruments appropriate for NE research. A survey has been drafted to obtain additional detailed information from these facilities and to identify additional facilities for inclusion in the NEID.
- The ATR NSUF program review meeting was held Dec. 9-10 at L'Enfant Plaza. In addition to NSUF staff and users, NE-4, NE-5 and NE-7 representatives attended the meeting.
- U.S. patent 8,903,035, Neutron Absorbers and Methods for Forming at Least a Portion of a Neutron Absorber, was issued Dec. 2. The inventors are Donna Guillen, Doug Porter, Dave Swank and Arnie Erickson.
- PNNL has completed sectioning of the U.C. Berkeley hydride fuel rodlet 1 (highest burn-up) and is currently polishing samples in preparation for optical metallography.

Upcoming Meetings/Events

- Mike Worley and Shane Johnson will be visiting INL Jan. 22 for an NSUF strategy discussion.
- Rory Kennedy will be attending a NSLS-2 Beamline Advisory Team meeting at Brookhaven.
- NSUF access feasibility studies for the Consolidated Innovative Nuclear Research FOA applications will be completed before Feb. 19.
- In February, Jim Cole will be attending the OECD NEA Expert Group on Innovative Structural Materials meeting in Paris, France.
- Jim Lane and Doug Copsey of Writers Ink are tentatively scheduled to visit PNNL in February to prepare an article for the NSUF annual report.
- University of California-Berkeley Principal Investigator Mehdi Balooch will visit PNNL in February to observe measurements and help finalize plans for completing the desired suite of analyses. His visit is being coordinated to coincide with the visit of Jim Lane and Doug Copsey.

Awarded Research Projects

RTE #2 (14-485 and 14-486): Nanoindentation and TEM work on the T91, HT9, HCM12A and 9Cr ODS specimens has been completed at CAES by Boise State Principal Investigators (PIs) Janelle Wharry and Cory Dolph. This completes RTE #2. Specimens will be returned to MFC in the coming weeks.

RTE #3 (14-482): A new RTE for NCSU has been awarded for examination of nickel-based specimens from the NCSU A-capsule. The scope of work for this experiment is similar to what was completed for Ahmad Alsabbagh, with plans to look at nano- and regular-grain specimens using TEM, XRD, micro-hardness and tensile testing. SEM will be used to examine the fracture surface of the tensile specimens. The student Principal Investigator (PI), David Woodley, has completed TEM and hardness analysis of both the nano- and regular-grain materials. Samples have been sent to the Analytical Lab for XRD analysis. The brittle nature of the nanograin material has complicated analysis efforts, particularly with tensile testing. David Woodley has sent unirradiated specimens to MFC for analysis to provide a baseline for the data. Tensile specimens will be worked in FASB. The furnace has been removed from the load

frame and is being readied for testing. SEM will be performed in FASB after testing is complete. Samples will be transferred to FASB once more detailed counting has been performed by the Analytical Lab. Completion of this work is pending authorization of radiological work in EML and FASB.

University of Illinois 355 (12-355): Thirteen tensile specimens have been prepared and loaded for shipment to APS. Only the specimens with a radiation exposure of 1 dpa or less have dose rates < 5 mRem/hr @ 30 cm, will be shipped, limiting the number of specimens available for testing in APS. The planned beam time at APS on April 10 was postponed until MRCAT resolved concerns over handling of the radioactive specimens. Cold testing has been performed by MRCAT and APS personnel. The new beam time has once again been delayed. The new date is expected in calendar year 2015. INL is ready to send the specimens as soon as authorization to ship is provided.

MANTRA (09-197): Sample preparation on MANTRA 1 and 3 capsule specimens continues. Two shipments have been made to ATLAS to date. More shipments will be needed to complete MANTRA 1 and 3. Capsule 2 disassembly was completed in HFEF and samples were sent to Analytical Lab. Sample dissolution will begin once glovebox work in the Analytical Lab has been authorized. MANTRA 1 and 3 work has resumed (at a slow rate) with additional targets being prepared. The project will work with ATLAS personnel to determine the next shipping date.

Drexel MAX (09-204): TEM and XRD analysis of the TiAl and TiSiC specimens for capsules D, E and F is complete. Drexel PI Darin Tallman returned to CAES in November to perform FIB and TEM analysis on the additional 18 MIT specimens sent to CAES. Specimens from Capsules H and J were loaded for shipment to EML and will be shipped once radiological work in EML is authorized. Darin returns to CAES in March, working toward completing his degree.

Utah State University (09-157): Laser flash on USU specimens has yet to begin because of the radiological work stand-down and problems with the FASB laser flash instrument. Completion of this work is pending restart of radiological work in FASB and repair of the instrument. The team is considering sending the specimens to IRC for analysis if the specimens are permitted in the facility (to be determined by facility radiological engineering). Shipment of additional specimens from HFEF (for tensile testing and hardness testing) is delayed by the radiological stand-down in EML. The shipment will be made once radiological work is authorized.

University of Central Florida (UCF) (10-242): TEM and foil specimens will be moved from HFEF to EML in the coming months. Completion of this work is pending restart of radiological work in EML and the shipment of additional specimens from HFEF. Additional specimens have been loaded for shipment to EML and will be shipped once radiological work in EML is authorized.

University of California-Berkeley (UCB) (10-244): Capsule analysis is continuing as outlined by the contract. Work is expected to be completed by mid-year.

University of California-Santa Barbara-2 (09-153): The experiment was unloaded into the HFEF main cell and moved to the decontamination cell for disassembly. Disassembly was initiated, but could not be completed because the packets could not be separated from the inner tube. A tool is being fabricated to assist in disassembly. Once disassembled, they will be packaged into shipping pigs and delivered to ORNL. Isotopic calculations have been provided to ORNL for review and approval. With work delays in HFEF, shipment is expected in late January or early February.