



September 2012 Bimonthly Report

Accomplishments and Look Ahead

September 2012

- ATR NSUF co-sponsored Jean-Francois Villard, CEA, to visit INL and present "Progress in Instrumentation Development for the Future Jules Horowitz Reactor" at an Idaho American Nuclear Society event held Sept. 11, 2012.
- ATR NSUF Representatives visited AECL and discussed possible research interactions.
- ATR NSUF Scientific Director visited Argonne National Laboratory to discuss their proposal for a combined ion beam/synchrotron facility.
- ATR NSUF Program Manager attended the Test, Research and Training Reactor meeting and presented information related to the ATR NSUF Sample Library.
- Call for Rapid Turnaround Experiment (RTE) proposals closes Sept. 30, 2012.

October 2012

- ATR NSUF will host a Colloquia in the Center for Advanced Energy Studies (CAES) in Idaho Falls, Idaho on Oct. 2 from 2-3pm featuring speaker Frank Garner of Radiation Effects Consulting in Richland, WA.

December 2012

- ATR NSUF Researcher Dr. Yong Yang will lead a seminar about nuclear science and technology and renewable energy at the Center for Advanced Energy Studies (CAES) on Dec. 5, 2012 from 4-5pm.

Noteworthy News

ATR NSUF Leadership—Management Change



Todd Allen, ATR NSUF Scientific Director

Beginning in January 2013, ATR NSUF Scientific Director Todd Allen will officially assume the position of Idaho National Laboratory's (INL) Deputy Laboratory Director for Science and Technology, replacing Dr. David Hill.

Todd has served as Scientific Director for the ATR NSUF since 2008. Under his direction, the user facility has added 10 partner facilities, developed a top-notch Users Week, grown capabilities at INL facilities, and developed mechanisms for coordinated research between user facilities. Todd's enthusiasm and vision has made the user facility an interesting and vital place to work, and we will miss him. However, this new position appointment is a positive indication that the INL values the NSUF concept.

ATR NSUF is looking now for someone from the university community to take over the Scientific Director position. In his new role as Deputy Laboratory Director, Todd will retain oversight of the ATR NSUF Program. In the interim, Frances Marshall, ATR NSUF Program Manager, will be acting as Scientific Director.

During this transition, please be assured that we greatly value the ATR NSUF community and will continue to work to optimize your ability to get access to the high-value equipment needed to do your R&D. All of the same staff who you have been working with thus far will continue to work with you. Please do not hesitate to contact Frances Marshall (208-526-8947/frances.marshall@inl.gov), Jim Cole (208-526-8101/james.cole@inl.gov), Jeff Benson (208-526-3841/Jeff.Benson@inl.gov) or Mary Catherine Thelen (208-526-5209/mary.thelen@inl.gov) if you have any questions or concerns.

ATR NSUF Goes International—Samples Sent to Oxford

ATR NSUF facilitates collaborations of all kinds, but recently had a first when we successfully delivered irradiated samples across international boundaries to the United Kingdom. The University of California, Santa Barbara (UCSB) irradiation experiment titled "Characterization of the Microstructures and Mechanical Properties of Advanced Structural Alloys for Radiation Service" irradiated over 1000 samples of various types and materials to create a sample library the likes of which has never before existed.

(Continued on page 2)



ATR
National Scientific User Facility

International Collaborations Cont.

(Continued from page 1)

From this library, researchers can gain a better understanding of the irradiation environment and its effects on materials. Through this research project, UCSB Professor Bob Odette, working with University of Oxford Professor Steve Roberts, developed a mechanical property measurement system to test one of these samples. Oxford student Christopher Hardie travelled to ATR NSUF this past spring to use focused ion beam (FIB) in the Center for Advanced Energy Studies Microscopy and Characterization Suite to prepare a sample for this test. The sample was shipped to Oxford in August.

ATR NSUF Bimonthly Report Transitioning to Quarterly Publication

Beginning with the December 2012 issue, the ATR NSUF Bimonthly Report will become a quarterly report, with anticipated publications in March, June, September, and December. This publication change will better align the report with the ATR NSUF program schedule and allow for development of more in-depth articles. Look for the new and improved ATR NSUF Quarterly Report this December.

ATR NSUF Research from the Foreign National User Perspective

We typically highlight our research projects, but in this bimonthly report we chose to focus on the people behind the research – in particular researchers who are not US citizens. These researchers bring a unique perspective to the ATR NSUF projects and in the articles that follow, share their visions for the future of nuclear energy in the US, their home country, and the world.

We had the opportunity to talk with three of our many non-US citizen researchers – one from Iran, one from Kazakhstan, and one from China – and asked them about their experiences working on ATR NSUF experiments and how it has contributed to their university degrees and future careers.

Somayeh Pasebani—Hometown: Tehran, Iran

Somayeh “Somi” Pasebani is a PhD student in Materials Science and Engineering at the University of Idaho (UI) in Moscow, Idaho. Originally from Tehran, Iran, Somi started working on the University of Idaho Rapid Turnaround Experiment (RTE) entitled, “Study of the Microstructure of 14LMT before Irradiation” in November of 2011. The experiment looked into developing materials used for fuel cladding by using the Spark Plasma Sintering (SPS) technique.

Somi’s role in the experiment was to fabricate a novel nanostructured ferritic steel (NFS) with nanoscale oxide precipitates via SPS to evaluate its mechanical properties and study the microstructural characterization and thermal behavior. The final developed material will have high strength at both room and higher temperatures, good thermal stability, creep resistance, and irradiation stability (which makes it appropriate to be used as a fuel blanket for next generation nuclear reactors).

Somi performs microstructural studies by using Transmission Electron Microscopy (TEM), Atom Probe Tomography, and Electron Back Scatter Diffraction (EBSD) in the INL Center for Advanced Energy Studies (CAES) Microscopy and Characterization Suite (MaCS) laboratories. Her experiments tested out a new material that uses a different oxide additive in NFS. Traditionally, Y_2O_3 has been used as the oxide additive to the NFS in order to stabilize the microstructure at higher temperatures, but research has shown that the addition of La_2O_3 could provide improved mechanical properties. The experiment built on this La_2O_3 oxide additive research in combination with utilizing SPS as a novel route for consolidation. One benefit of a new oxide additive is that it

(Continued on page 3)



ATR
National Scientific User Facility

Foreign National Experience Cont.

(Continued from page 2)

would be more readily available in the US, which makes this potential new material much more economical. Because there is little to no research using the SPS technique in this way, Somi's work on the NSUF project broke new ground.

Somi said working on this ATR NSUF research project has definitely benefited her current education and her future career path. "This research has given me a deeper knowledge of materials science and its applications," she said. "I have learned to use new facilities, machines, equipment, and data analysis methods, plus I am building my personal research capabilities." After finishing her ATR NSUF project, Somi will return to UI to finish her PhD and plans to graduate in Winter 2013. She would like to continue in a similar field working as a post-doc or in a full time position

When was asked why she pursued education in materials science, Somi said she was looking for something that combined math, physics and chemistry and was full of exploration and innovation. Her area of study is very versatile and covers many areas – so she is not pigeon-holed into only one career option. Somi says she is very happy with her field. "I am able to innovate with new materials, evaluate their properties and improve them. My work is dynamic and not repetitive – I get to learn something new every day."

Somi said she loves her home country, however she loves the US as her second home and prefers to stay in the US and work here until hopefully a positive change happens in the political and economical situations in her native country. She misses her family and friends and the beautiful variety of terrain in Iran – the Caspian Sea and the Persian Gulf, mountains, and even deserts. In her free time, Somi enjoys hiking, camping, and photography, which makes UI and her NSUF research in southeast Idaho an ideal location. "In Iran, I used to live in a city of 9-10 million people and had a typical commute of 1-2 hours daily," said Somi. "This area of the country is beautiful and peaceful and I love the open space and pure beauty of Idaho's nature."

Although Somi is not directly involved in the nuclear energy field, as far as the future of nuclear energy in the US and in the world, she sees a huge demand for energy now and expects demand to continue increasing. "In the future we will have to provide efficient sources of energy and therefore will need to keep developing nuclear energy to increase safety and meet those energy needs," she said. Somi would like to see Iran put more investment into research in petrochemical, solar, and nuclear infrastructure as part of a complete energy portfolio.

For now, Somi will continue to enjoy her time in Idaho. "People in Idaho are very nice - always smiling, welcoming and friendly. I am very lucky to be able to study here in Idaho," she said.

(Continued on page 4)



Somayeh Pasebani performs consolidation experiments on steel powder in the Spark Plasma Sintering device in the Advanced Materials Laboratory at CAES.

Photo by Bryan Forsmann, CAES



Foreign National Experience Cont.

(Continued from page 3)

Assel Aitkaliyeva—Hometown: Almaty, Kazakhstan

Assel Aitkaliyeva, originally from Almaty, Kazakhstan, is a PhD student at Texas A&M University studying Materials Science & Engineering. She is currently on a year-long internship working at the Materials and Fuels Complex (MFC) at INL where she studies metal fuels, but was part of the ATR NSUF research team that recently completed an RTE titled, "Radiation Stability and Integrity of Amorphous Metal Alloys for Application in Harsh Environments." In June and August of 2011, Assel performed the specimen preparation for the experiment using a dual beam microscope and microscopic characterization on the TEM in the CAES MaCS lab. The goal of the experiment was to study the radiation response of glasses and the team met their research goal by using heavy ion irradiation to simulate a reactor environment.

Although her NSUF experiment is now complete, Assel still has the opportunity to help with User Facility-related projects on occasion. For instance, her experience using the TEM and other equipment while working on her NSUF project made her the ideal presenter to explain the equipment to a group of ATR NSUF Users Week visitors who toured INL's CAES facilities.

While the research project did not specifically tie into Assel's PhD dissertation, she gained valuable experience working in the lab and learned about research outside of her immediate field. "My research project for ATR NSUF definitely benefited my future career," said Assel. I met a lot of people who work in the field I'm interested in and was able to find the doctoral internship I am currently working in at INL because of the research I performed at NSUF."

Assel has been in the US for about five years and has traveled to various places around the country. She said every place she has visited has something unique. "I love to travel and have an interest in architecture. In any place I visit, I try to dig into its history and learn about it on a deeper level." Assel also enjoys hiking, yoga, and reading.

In fact, her love of reading was one of the main things that attracted her to science in the first place. "I blame my parents," she joked, "they taught me how to read instead of hiring a baby sitter." As far as her interest in pursuing a career in science, Assel said, "I read a lot as a child and always wondered how things worked and why they worked the way they do. I had a really good physics teacher in middle school who was able to explain in simple terms how things worked." That inspiration led her to pursue a BS in Physics, MS in Nuclear Engineering, and now her PhD.



Assel Aitkaliyeva explains the equipment available to researchers to a group touring INL's CAES facilities.

(Continued on page 5)



ATR
National Scientific User Facility

Foreign National Experience Cont.

(Continued from page 4)

Assel, like many of those in her field of nuclear materials characterization, would like to see the revival and growth of nuclear energy in the US and world, however Fukushima dealt a big blow to the nuclear industry. “It will probably be slow growth in the next couple of years,” she said, “but hopefully interest will not decline. It would be nice to see development in spent fuel and reprocessing use in the US and development of new types of reactors.”

Assel’s internship at MFC will end in early September and she will be graduating in December 2012. She is looking for a post-doc opportunity and hopes to stay in the research field, but her plans for the future are fairly flexible. The thing she misses most about home country is her family, but she looks forward to showing her parents the US when they visit – hopefully if they can make the trip to the US for her graduation in December.

Yong Yang—Hometown: Jiangsu Province, China

Yong Yang, originally from Jiangsu Province, China, is currently an assistant professor at the University of Florida (UF) and has been involved in two ATR NSUF experiments in the past. Yong was one of the first researchers to work on the University of Wisconsin Pilot project titled, “Irradiation Test Plan for the Advanced Test Reactor National Scientific User Facility/University of Wisconsin Pilot Project” that started in 2008. Although Kumar Sridharan was the PI, Yong said he learned a lot about planning neutron irradiation experiments and about coordinating post-irradiation examination (PIE) with INL. He had worked on irradiation experiments before, but through ATR NSUF, now knows how to plan the whole process from scratch. “I’m interested in continuing this kind of research on stainless steels for the LWR sustainability program and on martinstic steel for the NGNP program,” said Yong.



Yong Yang performs PIE on an irradiated 12 Cr model alloy using FIB and TEM at the CAES MACS lab.

This work on the pilot project helped Yong leverage himself so that he could write other proposals to continue the research in this area. Yong emphasized that his experience with ATR NSUF was invaluable, “I learned how to write proposals for nuclear research,” he said. “I am continuing research on nuclear materials and helping grow this research direction for the nuclear program at the University of Florida.”

After the Pilot Project, Yong went on to lead an ATR NSUF project as the principal investigator for the PIE experiment, “Radiation Stability of Ceramics for Advanced Fuel Applications” that began in 2009 and completed in 2011. The major motivation for this project was to benchmark the proton irradiated samples against neutron irradiated samples and synergize the ATR NSUF program with other Nuclear Energy (NE) programs by analyzing the same materials with two different types of

irradiation. “We met our research goal,” said Yong. “At certain temperature ranges, proton irradiation simulates neutron irradiations. For ceramics, that temperature is around 800 degrees Celsius for both kinds of irradiation.”

(Continued on page 6)



ATR
National Scientific User Facility

Foreign National Experience Cont.

(Continued from page 5)

tions. We also found that there are strong similarities between the two kinds of irradiations at the same temperature and the same dose.”

While neither of the projects directly tied into his dissertation, Yong said both benefited his career. “I learned a lot and I believe ATR NSUF is a core in the field [of nuclear energy research]. If you want to stay in the field of nuclear materials you need to stay in the core.” ATR NSUF provides access to capabilities, a key component to research. “If you’re going to put a material into a new reactor you need to test it,” continued Yong. “Modeling isn’t enough, so having access to a reactor is very important.” Yong credits his research projects at NSUF with helping him evolve from a post-doc position to a research scientist to his current position as an assistant professor at UF.

The thing Yong misses most about his home country is his family, but he enjoys his time in the US. “It’s quieter here and I love the research I get to do,” said Yong. “I get to do what I love and get paid for it!” Yong developed an interest in science over time, but has always been fascinated with mathematics and physics, and getting to the bottom of scientific questions. He has been in the US for about 11 years and is currently living in Gainesville, Florida with his wife, Emily, where they recently purchased a home.

Currently Yong is researching radiation damage, corrosion and LWR aging management for nuclear materials, and performing some work on advanced fabrication and joining technology for nuclear materials. In the short term, Yong is thinking about writing a RTE proposal in hopes of working on a third research experiment through the ATR NSUF. His long term plans, however, are to perform a full irradiation experiment, something that would help him carryout his vision for the future of nuclear energy in the US and China. “I see nuclear energy in the US as something that is here to stay,” said Yong. “I would like to bridge the gap between US and Chinese nuclear interests.” Yong explained that the US has advanced technologies that are not available in China and China is ready to build new reactors, whereas the US is not. Researchers like Yong can help bridge the gap to allow China to learn from US research and the US to learn from China about the new reactors they are building.

Yong says studying abroad is valuable to the world for reasons like this knowledge sharing for a mutual benefit. Programs such as ATR NSUF also play a role in bridging the gap by helping connect researchers to capabilities. “ATR as a user facility functions more like a research hub by promoting communications, connectivity and collaborations,” said Yong.