

ANNUAL REPORT

2015





*CAES has become a proven model that institutions throughout the world aspire to replicate.*

## Message from the Director:

CAES is about using the power of collaboration to solve complex technical challenges as a team. CAES is about regional partnerships that create opportunities for our students, industries, and research centers. CAES is about leveraging regional partnerships for global competitiveness. And most importantly, CAES is about enabling a clean energy future for generations to come.

When the concept of Idaho's independent research institutes coming together to share research, staff, and educational resources was first imagined, it seemed like an impossible goal. However, since CAES was formally established in 2009, it has become a proven model that institutions throughout the world aspire to replicate. Last year, we expanded to a regional collaboration when University of Wyoming joined the team.

This year, the CAES collaboration has placed added emphasis on research that increases industry competitiveness while opening more opportunities for our students. We're developing innovations to help industry compete and to help our nation realize a clean energy future. As the world is rapidly changing its approach to energy, CAES is helping discover new approaches for energy production and energy use that will allow us to stay competitive in this dynamic landscape. It is estimated that \$67 trillion dollars will be invested in energy technology globally over the next 25 years. CAES researchers will

help regional stakeholders compete for a share of these markets, and will help our students compete for jobs. The future will be exciting indeed!

Over the past year, we've had many exciting advances. We expanded our materials and catalysis capabilities by bringing in capabilities like the Temporal Analysis of Products (TAP) reactor and a picoindenter for in-situ tests in the Microscopy and Characterization Suite. We are developing some big, impactful projects, including the Frontier Observatory for Research in Geothermal Energy (FORGE) and the food-energy-water nexus. We brought in new high-caliber research staff to help take our research to the next level. We established an Industry Advisory Board to enhance public-private partnerships and engage industry partners to work with CAES on technology commercialization for maximum impact.

CAES had a great year and we look forward to continue building world-class capabilities, working with the region's best researchers, educating the next generation of energy scientists, and using our expertise to help industry succeed in fast-paced global markets.

Sincerely,

Steven Aumeier

Director, Center for Advanced Energy Studies

## FY 2015 | By the Numbers

INVESTMENTS:

**\$3 MILLION**  
STATE OF IDAHO INVESTMENT IN CAES

**\$347,000**  
UNIVERSITY OF WYOMING INVESTMENT IN CAES

**\$16.93  
MILLION**

RESEARCH PROGRAM AND OTHER FUNDING FOR CAES INCLUDING LABORATORY DIRECTED RESEARCH AND DEVELOPMENT FUNDING AND RESEARCH GRANT AWARDS FROM DOE, NSF, NRC, AND PRIVATE INDUSTRY

**\$6.84  
MILLION**

IDAHO NATIONAL LABORATORY'S INVESTMENT IN INFRASTRUCTURE, OPERATIONS, AND RESEARCH

COVER: THE TEMPORAL ANALYSIS OF PRODUCTS (TAP) REACTOR LOCATED IN CAES.

OUTREACH:

**1558**

VISITORS TOURED THE CAES IDAHO FALLS FACILITY IN FY 2015

**1891**

VISITORS EXPERIENCED THE CAES COMPUTER-ASSISTED VIRTUAL ENVIRONMENT (CAVE) 3-D DATA IMMERSION RESEARCH ENVIRONMENT

**237**

CAES PRESENTATIONS, PUBLICATIONS, AND PROCEEDINGS IN FY 2015

**84**

CAES AFFILIATES COLLABORATED WITH 84 COMPANIES

STUDENT IMPACT:

**87**

STUDENTS FROM THE CAES PARTNER UNIVERSITIES INTERNEED AT IDAHO NATIONAL LABORATORY IN AREAS INCLUDING MECHANICAL ENGINEERING, MATERIALS SCIENCE, GEOTECHNOLOGY, NUCLEAR ENGINEERING, AND COMPUTER SCIENCE

**249**

STUDENTS WORKED ON CAES-RELATED PROJECTS IN AREAS INVOLVING ELECTRICAL GENERATION TECHNOLOGIES (NUCLEAR, COAL, GAS, RENEWABLE), ENERGY POLICY, MATERIALS SCIENCE ENGINEERING, NUCLEAR SCIENCE, AND HUMAN FACTORS AND STATISTICS



*"I was particularly struck by the conversations I've had since I arrived here [at CAES]. Frankly, I hadn't realized the extent to which you have moved in tying your efforts together with those of industry, [tying] your efforts with academia...Frankly, you're far ahead of most of the places I go and talk about this. . . It's commendable on your behalf."*

*-Norm Augustine (above center), retired chairman and CEO of Lockheed Martin and a member of a special committee convened by Energy Secretary Moniz to assess the effectiveness of the Department of Energy national laboratories, visited the Center for Advanced Energy Studies as a guest of the University of Wyoming on April 8, 2015.*



## Regional Leadership

### CAES co-sponsors Intermountain Energy Summit

On Aug. 18-19, the Center for Advanced Energy Studies (CAES) at INL co-sponsored the Second Annual Intermountain Energy Summit in Idaho Falls to provide an opportunity for individuals of the energy community to come together to discuss environmental and energy topics, and present ideas on how to best overcome various obstacles. This year's theme, the Energy-Water Nexus, was of interest due to changing weather patterns leading to drought conditions in much of the Western states. Pressure from growing populations and increased energy extraction is exacerbating the impact of increasingly limited freshwater availability. Speakers and notable attendees included: John Kotek, DOE assistant secretary for Nuclear Energy, Lynn Orr, DOE undersecretary for Science and Energy, U.S. senators Jim Risch and Mike Crapo, Rep. Mike Simpson, Idaho Lt. Gov. Brad Little, NRC Commissioner Kristine Svinicki, Asst. Secretary of the Navy Dennis McGinn and the EPA's Lek Kadeli.



### Energy Policy Research Conference 2015

In September 2015, over 100 attendees from 28 universities and colleges, 18 industry or nonprofit organizations and three national laboratories came together for the 5th Energy Policy Research Conference in Denver, Colorado. Each year, the CAES Energy Policy Institute, headquartered at Boise State University, organizes and hosts the conference. Over the course of this year's two-day conference, participants gave 55 presentations across 14 panels on topics ranging from "Coal Regulation and the Clean Power Plan" to "Renewables Integration: Scenarios and Novel Approaches." Jim Rogers, former CEO and Chairman of Duke Energy, delivered the keynote address. Select papers from the conference were published in a symposium issue of *The Electricity Journal* (October 2015).

KEYNOTE SPEAKER JIM ROGERS,  
FORMER CEO AND CHAIRMAN OF  
DUKE ENERGY, THE LARGEST UTILITY  
IN THE U.S., ADDRESSES THE CROWD  
AT THE ENERGY POLICY RESEARCH  
CONFERENCE.

CAES PROGRAM  
DEVELOPMENT DIRECTOR  
MICHAEL HAGOOD  
ADDRESSES THE  
INTERMOUNTAIN ENERGY  
SUMMIT (ABOVE).

## 5th International Advanced Coal Technologies Conference

The 5th International Advanced Coal Technologies Conference (IACTC) took place in Jackson Hole, Wyoming, on Oct. 6-7, 2015. Each year, the conference rotates among United States, Australian, and Chinese locations. The IACTC conferences seek to advance, through collaboration with global partners in policy, education, and research, the environmental and economic use of coal to meet world energy sustainability and security. The theme of the 2015 IACTC conference was to explore new opportunities for coal through carbon engineering and CO2 utilization and storage.

The conference brought together an international array of leading energy experts from government, industry, academic, and research sectors to discuss and share recent advancements in the development and deployment of low-emission coal-based power and carbon-emission mitigation technologies. The conference was hosted by the University of Wyoming School of Energy Resources (SER) in conjunction with Shaanxi Provincial Institute of Energy Resources & Chemical Engineering.



## Meetings and Workshops

In 2015 CAES hosted or sponsored over 20 meetings that attracted researchers from the region and beyond:

- 69th Northwest Regional Meeting (NORM) of the American Chemical Society
- Advanced Nuclear Manufacturing & Supply Chain Conference (Premiere Technology)
- Big Data Workshop
- Clean Coal Technology Research Fund Symposium
- Energy Education Summit
- Energy Policy Research Conference
- Intermountain Energy Summit
- International Advanced Coal Technologies Conference
- International Conference on Future Technologies for Wind Energy - WindTech 2015
- Landscape Discussion on Energy Law and Policy in the Rockies
- Materials, Modeling, Simulation, and Visualization (MMSV) Workshop
- Midwest Energy Conference- St. Louis- Energy Workforce Development
- Modeling, Experimentation & Validation (MeV) Summer School
- Nuclear Innovation Workshop
- Nuclear Security, Alternative Technologies and Consequence, Management for the Health Physicist Workshop
- Small Modular Reactor Working Group
- Snake River Geothermal Workshop
- Symposium G: Next Generation Electrochemical Energy Storage and Conversion Systems
- University of Idaho Engineering Design Expo
- University of Wyoming Meet and Greet
- Western Initiative for the Dairy Environment Workshop

PANELISTS AT THE 5TH  
INTERNATIONAL ADVANCED  
COAL TECHNOLOGIES  
CONFERENCE IN JACKSON  
HOLE, WYOMING.

## Research with Impact

### Leading the next generation of geothermal energy research

CAES and INL are at the forefront of one of five groups pursuing the development of Enhanced Geothermal Systems for the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy.

The Snake River Geothermal Consortium is proposing to create an engineered geothermal reservoir 8,000 to 12,000 feet below land surface in the southwest corner of the INL site. Water will be circulated through the reservoir to harvest natural geothermal heat for producing electricity.

Phase 1 studies for the Frontier Observatory for Research in Geothermal Energy (FORGE) are underway thanks to \$400,000 that DOE awarded to INL in April. CAES' Dr. Robert Podgorney believes the consortium has a good chance of being one of three participants selected for Phase 2, which involves up to \$29 million in funding.

Besides INL and CAES, other members of the consortium include DOE's National Renewable Energy Laboratory and Lawrence Livermore National Laboratory. The Center for Advanced Energy Studies includes Idaho State University, Boise State University, the University of Idaho and the University of Wyoming. The University of Oklahoma and the University of Utah have joined the consortium, and an advisory panel representing regulatory agencies, industry and environmental groups is on board. Private-sector partners include Baker Hughes, U.S. Geothermal, Campbell Scientific, Alaska's Chena Power and Mink Geohydro.

*"This is a great example of how the national labs will operate in the future, developing highly competitive industry, academic, government and laboratory partnerships that increase U.S. energy security and economic competitiveness; INL and CAES are national leaders in this regard, and FORGE is a great example of what we can do in the future," said Steven Aumeier, INL Associate Laboratory Director and Director of CAES.*

### Drying and detoxifying coal with carbon-free energy

Idaho National Laboratory and University of Wyoming are researching whether heat from a nuclear reactor can be used to dry and detoxify coal from the Powder River Basin. Drying coal with carbon-free energy like what is anticipated from NuScale's small modular reactor could improve the combustion efficiency and reduce CO<sub>2</sub> emissions, thus helping states that depend on coal-fired power meet increasingly stringent EPA requirements.



DR. ROBERT PODGORNEY  
HANDLES SAMPLES AT THE  
USGS CORE SAMPLE LIBRARY.



## Increasing the Safety of Nuclear Plant Components

Idaho State University received a \$200,000 grant from INL in 2015 to research the performance of nuclear power plant components under flooding conditions. The research, led by Dr. Chad Pope, encompasses small-scale testing of components to develop testing methodologies and gain insight into mathematical models to be used to represent component reliability. The research also includes investigation into the use of Smoothed Particle Hydrodynamic (SPH) modeling, a computational method used for simulating fluid flows.



BOISE STATE UNIVERSITY  
MECHANICAL ENGINEERING  
STUDENTS KAHLIL WILLIAMS  
AND JOEL HOOD LOOK AT A  
CONTROL PANEL.

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## Enhancing Industry Energy Efficiency

The CAES Energy Efficiency Research Institute Industrial Assessment Center (CEERI-IAC) based out of Boise State University is a DOE-sponsored program that offers businesses in the Mountain West in-depth energy assessments of their plant sites. An IAC team -- typically junior- and senior-year mechanical engineering students from Boise State, Idaho State or the University of Idaho -- studies the production methods and energy usage of a plant. The team meets the company representatives and takes tours, collects data and makes observations on how energy might be saved, and therefore, energy costs reduced. Within 60 days of the site visit, the team compiles a confidential report, including a detailed analysis and recommendations specific to the company site. On average, a visit by an IAC team will save a regional business more than \$55,000 a year and pay for itself within 12 to 18 months. To date, the Center has helped approximately 60 companies become more energy-efficient with their assessments.

## International Nuclear Safety Research

With a long-term solution for spent nuclear fuel disposal still in the distance, South Korea, which relies on nuclear energy for more than one-third of its electricity, is looking at pyroprocessing as a means of dealing with its growing stockpile.

Idaho State University and the Korea Atomic Energy Research Institute have engaged in fundamental nuclear safety research that will be necessary to any pyroprocessing facility that might be built. Work has been done under three contracts. The first addressed pyroprocessing safety and regulations. The second expanded on the first, delving into hazard evaluation and safety system selection. The third, a \$160,000 contract issued in September 2015, focuses on a pre-conceptual facility design, including initial hazard analysis, shielding and criticality safety and probabilistic risk analysis. Research is led by Dr. Chad Pope.





THE PALISADES RESERVOIR  
IN THE CARIBOU-TARGHEE  
NATIONAL FOREST.

### **Addressing the World's Food, Energy, and Water Needs**

By 2050, the world's population is expected to reach 9.6 billion. As a consequence, food production must nearly double by that time using roughly the same amount of energy and water. The University of Idaho-led Center for Advanced Energy Studies initiative on Food-Energy-Water is working on solutions to meet this rising demand and challenge to our resources.

Food processing requires lots of water and energy and is central to Idaho and the region's agricultural economy. Regional industries have major challenges in updating food processing infrastructure, reducing energy demand, minimizing impacts on the environment and conserving water. A new generation of workers needs to be educated to operate new technologies and solve problems for industries that are vital to our society and the world. The University of Idaho, in partnership with CAES, is stepping up to the challenge by exploring several research opportunities that will lead to more efficient food production and processing.

### **"NEET" Research**

Drs. Yanliang Zhang and Darryl Butt of Boise State University are leading a team that is researching how to keep tabs on the workings inside nuclear power plants under extreme conditions, like Fukushima in 2011. Zhang and Butt, a CAES associate director, are attempting to see whether heat from a nuclear power plant can be harnessed to drive self-powered sensor networks. Their work is being funded by a three-year \$980,804 grant from the Department of Energy called a Nuclear Energy Enabling Technologies (NEET) research and development and infrastructure award. Self-powered sensors eliminate the need for both an external energy supply and power cables. Their work is in collaboration with Dr. Vivek Agarwal of Idaho National Laboratory, and Dr. Zhifeng Ren at University of Houston. The research will significantly expand the existing partnership between BSU and Idaho National Laboratory, and will provide opportunities to train undergraduate and graduate students.



## Race for Rare Earth Elements

In 2014, the University of Wyoming joined CAES. With \$750,000 from the state of Wyoming, INL and UW began research this year on recovering and processing rare earth elements from domestic coal and coal by-products using methods that are efficient, cost-conscious and environmentally benign. The 17 rare-earth elements in the periodic table that are plentiful in the earth's crust but typically not found in economically exploitable ore deposits. Since 2000, there has been an explosion in demand for items that require rare earth elements: cell phones, tablets, computers, cameras, etc. Rare earth compounds are in batteries that power every electric vehicle and hybrid-electric vehicle. After China began selling rare earth elements at very low prices in the 1980s, production in the United States eventually flat-lined. When China cut exports in 2010, rare earth prices skyrocketed. That motivated new production in the United States and other countries.

## Prestigious Nuclear Engineering Grant

The University of Idaho's Nuclear Engineering Program received a \$434,048 faculty development grant, part of \$16.6 million the NRC awarded to academic institutions in 2015. This will allow the faculty to improve its experimental capabilities and computational resources. The funds will also provide summer support, allowing the faculty to develop ideas into relevant research proposals and new courses for the nuclear engineering program and its core capabilities: thermal hydraulics, passive safety systems, nuclear materials, fuel cycle and safeguarding and increased sustainability. The end result is not only innovative research but a greater number of well-educated graduates entering the nation's technological workforce. With the award of the FY-15 grants, the NRC has awarded more than \$138 million since the program began in 2007.



CAES SCIENTISTS ARE RESEARCHING HOW TO RECOVER AND PROCESS RARE EARTH ELEMENTS FROM DOMESTIC COAL AND COAL BY-PRODUCTS.

**\$1,000,000**

CAES RESEARCHERS WON TWO NATIONAL SCIENCE FOUNDATION EARLY CAREER AWARDS OF \$500,000 EACH

## Operating Safely and Effectively

### Operations

During 2015, the CAES consortium performed a comprehensive review of CAES operations, safety protocols, and practices. This was the first comprehensive review since CAES was established and provided an opportunity to examine protocols and practices against real operational history and activities. The review indicated that with some modest adjustment, the protocols and practices are effective when consistently implemented. The review also demonstrated that over time there is a possibility for loss of critical knowledge of systems as staff transition out of CAES, so the team is developing a more structured process to transfer knowledge of specific critical systems and operational practices.

### New Premier Capabilities & Equipment

#### Microscopy and Characterization Suite

##### Hysitron PI 95 TEM PicoIndenter

This TEM sample holder from Hysitron (right), in CAES' MaCS Lab, is capable of direct-observation nano-mechanical testing inside a transmission electron microscope (TEM). The PI 95 has been carefully designed for compatibility with JEOL, FEI, Hitachi, and Zeiss microscopes. With it, it is not only possible to image the mechanical response of nanoscale materials, but also to observe microscopic deformation mechanisms in real time.

479

NUMBER OF HOURS MACS WAS  
BOOKED IN JULY 2014

866

NUMBER OF HOURS MACS WAS  
BOOKED IN JULY 2015

81%

INCREASE IN HOURS BOOKED  
FROM JULY 2014 TO JULY 2015

CLOSE-UP VIEW OF THE NEW  
PICOINDENTER IN MACS.



## TAP Reactor System for Materials Characterization

### Temporal Analysis of Products

Installed in late September at the CAES facility in Idaho Falls, the Temporal Analysis of Products (TAP) reactor system gives researchers a new, very rare capability to support advanced manufacturing. There are fewer than 20 TAP systems in the world and, counting the one at CAES, only three in the United States. Researchers plan to use TAP to design more energy-efficient catalysts for building chemical intermediates from abundant domestic shale gas rather than breaking down petroleum. These chemicals are essential to making products as diverse as disposable diapers and diesel fuel.

### X-ray Diffractor

Located in CAES' Advanced Materials Lab, the X-ray diffractor is used to detect structures in crystalline materials, metals and alloys, minerals, organic and inorganic compounds and polymers. Diffraction allows for quick, nondestructive analysis without the need for extensive sample preparation. It gives laboratories around the world the ability to quickly characterize unknown materials in such fields as metallurgy, mineralogy, forensic science, archaeology, condensed matter physics, and the biological and pharmaceutical sciences.



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REBECCA FUSHIMI ON THE TAP  
REACTOR (TOP) AND JATUPORN  
BURNS ON THE X-RAY DIFFRACTOR  
IN THE CAES ADVANCED MATERIALS  
LABORATORY (BOTTOM).





UNIVERSITY OF WYOMING'S  
3-D CAVE. PHOTO COURTESY  
OF UW.

## CAES Capabilities at University of Wyoming

Since University of Wyoming joined CAES in October 2014, CAES collaborators have gained access to a host of new capabilities. Highlights include:

### Shell 3-D Visualization Center, Advanced Research Computing Center, and the NCAR-Wyoming Supercomputer

The Energy Innovation Center's Shell 3-D Visualization Center houses the only four-walled, 3-D CAVE (Cave Automatic Virtual Environment) in Wyoming and is much like the Computer-Assisted Virtual Environment (CAVE) located in the CAES Idaho Falls facility. One of the laboratory's many capabilities is its ability to model oil, gas, and water movements and interactions in the subsurface environment, which will aid researchers and energy companies in deriving maximum value from their mineral resources.

The laboratory connects via 10-gigabit lines to one of the most powerful supercomputers in the region – the Wyoming National Center for Atmospheric Research Supercomputing Center (NWSC) located west of Cheyenne and UW's Advanced Research Computing Center (ARCC) – both essential for the complex simulations required in today's energy research.



### **Hess Digital Rock Physics Laboratory**

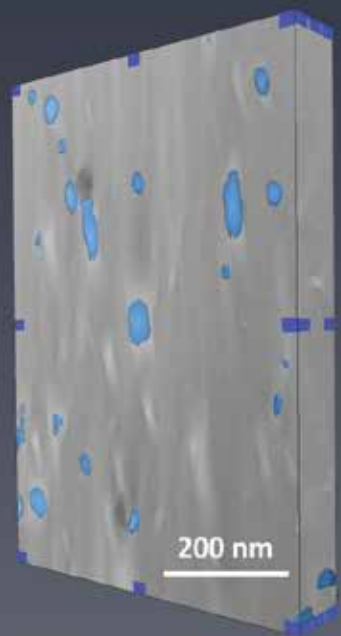
The Hess Digital Rock Physics Laboratory located in the Energy Innovation Center includes the most advanced high-resolution 3-D X-ray microscope available for studying underground oil and natural gas reservoirs. UW is the world's first university to provide access to this state-of-the-art tool.

### **Peabody Energy Advanced Coal Technology Laboratory**

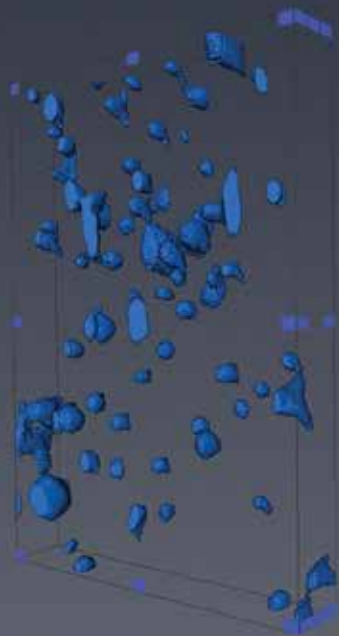
Located on the first floor of the Energy Innovation Center, the Peabody Energy Advanced Coal Technology Laboratory is used primarily to analyze and research coal conversion technologies. Scientists are researching methods to convert low-value fossil resources into higher-value products – or advanced conversion. This lab also supports research in the conversion of natural gas and coal into various manufactured products and liquid fuels.



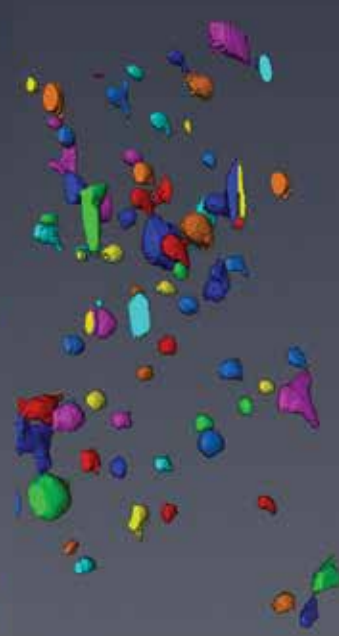
UNIVERSITY OF WYOMING'S PEABODY ADVANCED COAL LAB (ABOVE) AND HESS DIGITAL ROCK PHYSICS LABORATORY (INSET). PHOTOS COURTESY OF UNIVERSITY OF WYOMING



3D Electron Microscopy with TEM



Segmented 3D Pore Structure



Quantitative Evaluation of Pore Structure and Networks

3-D TOMOGRAPHY OF SHALE MATERIALS TAKEN WITH A TRANSMISSION ELECTRON MICROSCOPE.

### 3-D Software

Boise State University acquired Avizo, a 3-D analysis program for scientific and industrial data (CAES in Idaho Falls has Amira, a similar software). In materials science, geosciences or engineering applications, Avizo offers state-of-the-art image data processing, exploration and analysis features within an intuitive workflow and easy-to-use graphical user interface. It is being used to model shale formations by a team at CAES that includes BSU's Patrick Price and INL's Earl Mattson and Hai Huang.

### Ceramic Fiber Testing

Dr. Darryl Butt, BSU's Materials Science and Engineering Department chairman and an associate director of CAES, procured capabilities for testing the strength of ceramic fibers as thin as 1/10th the diameter of a human hair. CAES is working in collaboration with Advanced Ceramic Fibers, an Idaho Falls startup company producing high-performance, low-cost alpha silicon carbide/carbon fibers for use in specialty applications and metal and ceramic matrix composites. Butt also received \$80,000 from Idaho's Higher Education Research Council for two gloveboxes.

# \$80,000

RECEIVED FROM IDAHO'S HIGHER EDUCATION RESEARCH COUNCIL FOR TWO GLOVEBOXES



### ESTEC Upgrades

In response to a growing need for engineering technicians in the energy sector, the College of Technology at Idaho State University has established the Energy Systems Technology and Education Center (ESTEC) on the Idaho State University campus

in Pocatello. Partnership with CAES has supported the department's ability to produce graduates with the precise skills required by the energy industry. Upgrades include installation of a Distributive Control System (DCS) with Programmable Logic Controllers (PLC) integration and additional

SMART transmitters that communicate through wireless and HART protocols.

.....  
AN ESTEC STUDENT  
DEMONSTRATES A  
WIRELESS VALVE.

### Environmental Chambers

Purchased with an Idaho Global Entrepreneurial Mission (IGEM) grant, the benchtop environmental chambers in the Micron Engineering Center at BSU can produce extended temperature ranges as cold as -70 C. They allow for testing the durability of advanced energy materials, particularly those used in batteries, at extreme conditions without having to use a larger, stand-alone chamber.

### Linseis LFA 1000 Laser Flash

The Linseis LFA 1000 Laser Flash is the most modular and precise instrument for measuring the thermal diffusivity, conductivity and specific heat values of solids, powders and liquids. It is capable of six simultaneous samples ranging in temperature from minus 125 to 2800°C. Purchased with money from CAES' Micron donation, it is located on the Boise State University campus.

### Linseis LSR -3

If waste heat from hot engines and combustion systems could be captured and converted into electricity with thermoelectric devices, it could save billions of dollars. Linseis has developed the LSR -3 for evaluating Seebeck Coefficient/Electric Resistance measurements from minus 100 up to 1500°C. This capability is located on the Boise State University and is primarily being used for CAES-related thermoelectric research.

### PS6100 Spectroscopy

Located in Boise State University's Micron Engineering Center, Positron Annihilation Spectroscopy is a nondestructive materials testing technique that detects defect concentrations and residual stress in materials. Its common use is to investigate the source of large component failures in a nondestructive manner.



## People: Appointments, Awards, and Accomplishments

**Geoffrey Black**, Boise State University associate professor of economics, won the 2015 Energy Policy Institute Associate of the Year award.



GEOFFREY BLACK, WINNER  
OF THE 2015 ENERGY POLICY  
INSTITUTE ASSOCIATE OF THE  
YEAR AWARD.

**Darryl Butt**, Boise State University, received the Richard E. Tressler Materials Science Award and Lecture from Penn State University.

**Indrajit Charit**, University of Idaho, won the ASM-IIM Visiting Lectureship Award.

**John Gardner**, director of the CAES Energy Efficiency Research Institute based out of Boise State University, was elected a fellow of the American Society of Mechanical Engineers (ASME).

**Robert Hiromoto**, University of Idaho, submitted an Invention Disclosure Record (IDR) # BA-871, titled, "Branch and Bound Algorithm for Optimization of Dynamic Systems using LENDIT Metrics and S2R2 Sets," submitted by Joseph Nielsen, Robert E. Hiromoto and Akira Tokuhiko.

**Courtney Hollar**, a Boise State University graduate student, received a three-year National Science Foundation Graduate Fellowship.

**Adamu Kadiri**, an Idaho State University doctoral student, received the Roy G. Post Foundation Scholarship (nuclear waste management).

**Nick Kempf**, a graduate student at Boise State University, received a three-year DOE NEUP Graduate Fellowship.

**Jay Kunze**, Idaho State University, won a five-year Specialized Training of Nuclear Regulatory Commission (NRC) Inspectors on Motor Operated Valves award from the NRC Training Center in Chattanooga, Tennessee.

**Masego Lepule**, Boise State University student, won a William Fulbright Fellowship.

**Gabriel Potirniche**, University of Idaho, received a University Mid-Career Faculty Award.

**Deepesh Poudel**, an Idaho State University doctoral student, won the 2015 HPS F. Ward Whicker Scholarship, and award for graduate studies in health physics.

**Luke Schoensee**, a Boise State University undergraduate student, received a best paper award at the International Conference on Thermoelectrics.

**Matthew Swenson**, Boise State University student, won Best Student Poster Award in Microstructural Processes in the Irradiated Materials Symposium at The Minerals, Metals & Materials Society (TMS) Annual Meeting in Orlando, Florida.

**Janelle Wharry**, assistant professor of materials science and engineering at Boise State University, won a Nuclear Regulatory Commission Faculty Development Award.

**Janelle Wharry**, assistant professor of materials science and engineering at Boise State University, received a Nuclear Regulatory Commission Young Faculty Award.

**Claire Xiong**, assistant professor of materials science and engineering at Boise State University, won a Faculty Early Career Development (CAREER) award from the National Science Foundation.

## New Research Staff

### **Dr. Rebecca Fushimi** **Research Scientist, Idaho National Laboratory**

In summer 2015, CAES and INL's Materials Science & Engineering Department welcomed research scientist Dr. Rebecca Fushimi. Prior to coming to CAES, Dr. Fushimi was the executive director of the Langmuir Research Institute in St. Louis, Missouri, and an adjunct professor at St. Louis University. Her previous research focused on catalyst development and using a unique transient kinetic characterization technique (known as Temporal Analysis of Products, or TAP). In her current position, Dr. Fushimi will continue research using TAP and plans to expand use of TAP to interfacial chemistry and materials characterization.



### **Dr. Bob Borrelli** **Assistant Professor, Nuclear Engineering,** **University of Idaho**

In July 2015, CAES and University of Idaho welcomed Dr. Bob Borrelli as an assistant professor of nuclear engineering. Dr. Borrelli received his doctorate in nuclear engineering from the University of California-Berkeley. He then worked as a research associate at the University of Tokyo and postdoctoral researcher at UC-Berkeley. His dissertation and University of Tokyo research focused on radionuclide modeling in a high-level waste repository. Dr. Borrelli's UC-Berkeley postdoctoral and current research involves scientific computing applications to the development of safeguardability methodologies for the advanced fuel cycle.





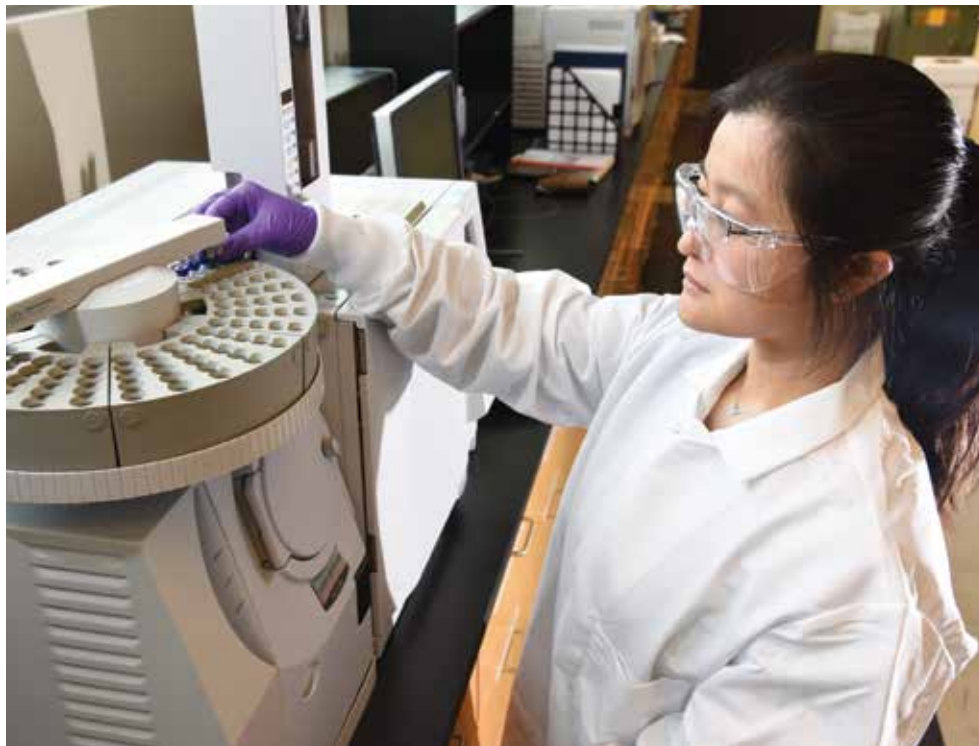
## Education & Outreach

1891

VISITORS EXPERIENCED THE CAES COMPUTER-ASSISTED VIRTUAL ENVIRONMENT (CAVE) 3-D DATA IMMERSION RESEARCH ENVIRONMENT.

1558

VISITORS TOURED CAES ON 90 DIFFERENT TOURS OF THE CAES FACILITY IN 2015.



### New CAES Competitive Graduate Assistantship Program

This year, University of Idaho (UI) and University of Wyoming (UW) created new CAES graduate assistantship programs to catalyze interdisciplinary, cooperative energy research and academic programs, promote workforce development, and engage industry partners in transformational energy programs. The program also promotes enhanced faculty-to-faculty inter-institutional collaboration requiring students in the program to work on a project that involves participation from at least two CAES member institutions. The University of Idaho program supports a UI graduate student at the master's or doctoral level for up to two years.

This year's UI CAES graduate assistants were electrical-civil engineering student Taylor Romenesko, working with Dr. Erik R. Coats on a project to integrate algal biomass into a broad-based Dairy Manure Resource Recovery Technology, and doctoral student Meng Shi, working with Dr. Haiyan Zhao on novel heterogeneous catalysts for synthetic fuels.

## University of Idaho

CAES GRADUATE ASSISTANT MENG SHI FROM UNIVERSITY OF IDAHO WORKS IN THE CAES ANALYTICAL CHEMISTRY LABORATORY.

This year, University of Wyoming funded four CAES graduate assistantships for collaborative research projects and one additional graduate assistant to develop a Western Energy Corridor Resource Map. The UW graduate assistantship topics include evaluating unconventional rare earth element resources from energy production in Wyoming, the technical, economical, and geological feasibility of rare earth element extraction from the nation's most prolific coal resources, nanocatalysts and separation technologies for advanced energy conversion and produced water treatment, and rare earth element catalyst research.



121

EVENTS HELD IN CAES IN 2015

963

TOTAL NUMBER OF STEM VISITORS

THE FIRST PLACE BOISE STATE UNIVERSITY TEAM AT THE 2015 COLLEGIATE WIND COMPETITION HELD AT NREL'S NATIONAL WIND TECHNOLOGY CENTER JUST SOUTH OF BOULDER, COLORADO. (PHOTO BY DENNIS SCHROEDER / NREL)

## Boise State University Wins Collegiate Wind Competition 2015

Seven teams of students from across the country gathered at the National Renewable Energy Laboratory's National Wind Technology Center (NWTC) for a fierce blade-to-blade wind turbine rematch. At the Department of Energy Collegiate Wind Competition 2015 Engineering Contest, teams of undergraduates tested original designs of model wind turbines in an on-site wind tunnel and presented their technical designs to wind technology experts. The Boise State University team took first place, winning the competition with an innovative wind turbine design.



**BOISE STATE UNIVERSITY**



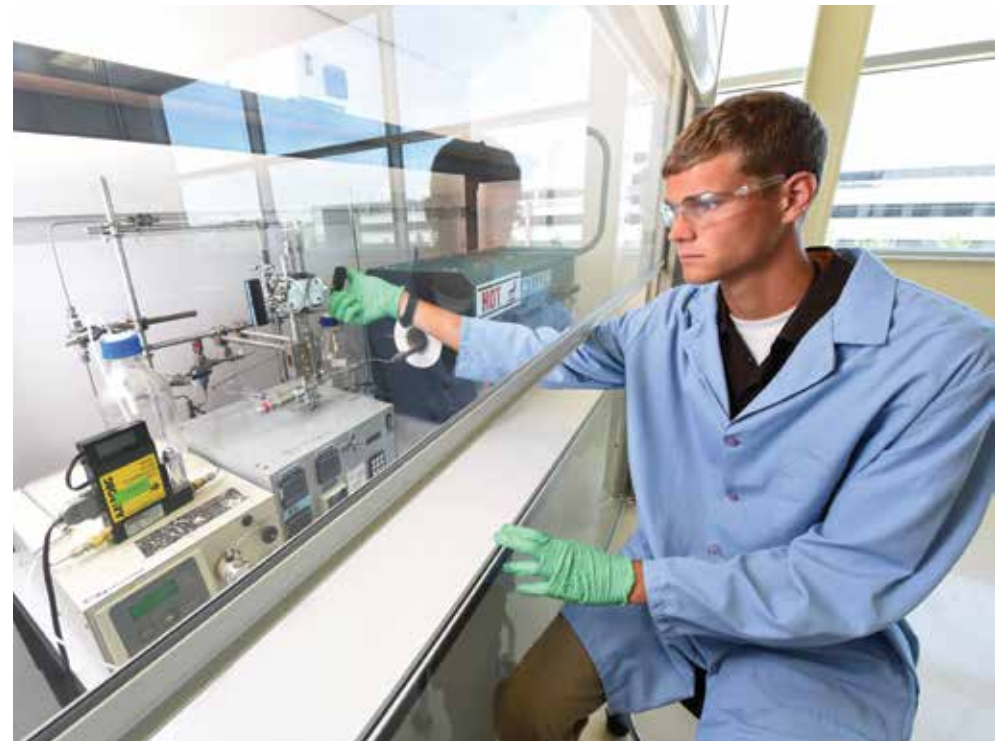
*“This internship was an amazing opportunity to understand what a job in scientific research would look like. It helped me to understand what I would like to do in my life.”*

*–INL 2015 summer intern*

INL SUMMER INTERN LOREN ANDERSON (TOP). AN INL INTERN RESEARCHES A SUPER CRITICAL FLUIDS CATALYST (BOTTOM).

## Internships

This year, 87 interns worked on CAES-related projects or came from CAES partner universities and worked on Idaho National Laboratory projects. CAES and INL internships provide opportunities for the best and brightest students to further their education by working with world-class scientists and engineers, plus showcase universities and INL to researchers from around the world. Interns have the opportunity to learn how to solve real-world problems under the guidance of distinguished scientific and technical experts.





### Idaho State University

McKenzie Whitesides, BA, English  
Joseph Pehrson, BA, Art and Business  
Wyatt Hill, BS, Psychology  
Sergio Hernandez, BS, Microbiology  
Caryn Wendt, BS, Civil Engineering  
Spencer Denton, BS, Computer Science  
Larinda Nichols, BS, Nuclear Engineering  
Mary Toston, BS, Nuclear Engineering  
Rhett Backstrom, BS, Computer Science  
Colter Rasmussen, BS, Electrical Engineering  
Sam Giegel, BS, Nuclear Engineering  
Shane Rielly, BS, Computer Science  
Nicholas Wilmot, BS, Accounting  
Brady Smith, BS, Accounting  
Jordan Castle, BS, ESTEC  
Julie Tomchak, BS, ESTEC  
Jacob Ivie, BS, ESTEC  
Bret Scott, BS, ESTEC  
Jonathon Taylor, BS, ESTEC  
Jonathon Taylor, BS, Mechanical Engineering  
Korbin Traughber, BS, Mechanical/Nuclear Engineering  
Sean McClellan, BS, ESTEC  
Daniel Baderstadt, BS, ESTEC  
Cameron Nielsen, BS, ESTEC  
Marko Sterbentz, BS, Computer Science  
Namie VanDyke, BS, Biology  
Marie Holmer, MS, Geotechnology  
Robin Baker, MS, Nuclear Engineering  
Dane Sterbentz, MS, Nuclear Engineering  
Shiloh Elliott, MS, Geographical Information Systems

### University of Idaho

Payton McGriff, BA, Architecture  
Mary Ellen Case, BS, Chemistry  
Morgan Dieckmann, BS, Civil Engineering  
Leilani Beard, BS, Environmental Sciences  
Michael West, BS, Electrical Engineering  
Hillary Hanson, BS, Applied Mathematics  
Hayden Smotherman, BS, Physics  
Keith Drew, BS, Computer Science  
Callan McGriff, BS, Mining Engineering  
Emily Mariner, BS, Computer Science  
Jeffery Porter, BS, Chemical Engineering  
Matthew Brown, BS, Computer Science  
Matthew Dieckmann, BS, Mechanical Engineering  
Cristofer Farnetti, BS, Mechanical Engineering  
Paden Rumsey, BS, Computer Science  
Hannah Pearson, BS, Computer Science  
Kateryna Savchenko, MA, Psychology  
Brendi Heath, MS, Environmental Science  
Zachary Spielman, MS, Experimental Psychology  
Lei Tu, PhD, Nuclear Engineering  
Thomas Ulrich, PhD, Neuroscience  
Kamshad Eshghi, PhD, Electrical Engineering

### Washington State University

Rachel Wood, MA, Geophysics  
Mathew Snow, PhD, Radiochemistry

### Boise State University

Arthur Figueiredo, BS, Materials Science  
Alex Schmidt, BS, Mechanical Engineering  
Riley Parrish, BS, Material Science and Engineering  
John Mulvaney, BS, Nuclear Engineering  
Emily Mariner, BS, Computer Science  
John-Paul Stroud, BS, Materials Science

### Stanford University

Yayu Hew, PhD, Aero/Astro Engineering

### University of Southern California

Juha Nieminen, MS, Astronautical Engineering  
Brian Franz, PhD, Astronautical Engineering  
Adarsh Rajguru, PhD, Astronautical Engineering

### Hillcrest High School,

Cole Mortensen, HS, General Studies

### Skyline High School,

Ryan Myers, HS, General Studies

### Brigham Young University-Idaho

Andrew Johnson, BA, Mechanical Engineering  
Brittany McGuinness, BA, Biology

### University of Wyoming

John Brouwer, BS, Energy Resource Management  
Rajiv Khadka, PhD, Computer Science

### Utah State University

Matthew Ralphs, MS, Mechanical Engineering  
Kurt Harris, PhD, Mechanical Engineering

### Texas A&M University

Akansha Kumar, PhD, Nuclear Engineering

### University of Utah

Manas Pathak, PhD, Chemical Engineering  
Gorakh Pawar, PhD, Chemical Engineering

### Virginia Tech

Meng-Jen Wang, PhD, Nuclear Engineering

### Missouri S&T

Mikayla Molnar, BS, Nuclear Engineering  
Philip Rexing, BS, Nuclear Engineering

### University of Tennessee

Kelsa Benesky, PhD, Nuclear Engineering

### University of North Texas-Denton

Sabbashish Meher, PhD, Material Science and Engineering

### University of Alabama

Kevin Schillo, PhD, Aerospace Systems Engineering

### Georgia Institute of Technology

Alexander Moore, PhD, Nuclear Engineering

DID YOU KNOW?

87

CAES AFFILIATES HOSTED 87 INTERNS FROM 18 ACADEMIC INSTITUTIONS IN 2015.

## Advancing Industry Competitiveness

84

COMPANIES CAES WORKED WITH ON COLLABORATIVE EFFORTS IN FY 2015

### CAES Industry Advisory Board Established

Primarily two drivers are defining the future outlook for global energy demands and infrastructure transitions: 1) a dramatic increase in the human population, and 2) the contribution of greenhouse gases to global climate change. This will place unprecedented pressure on our ability to provide sufficient energy, water and food. Our energy systems will undergo enormous transitions as we add more clean and renewable sources to existing fossil fuel and nuclear sources.

To meet this grand global challenge, CAES must leverage our collective expertise to partner with the private sector to advance regional energy solutions that have global impact. Our CAES Strategic Plan (2016-2022) calls out the necessity for CAES to become a national and global model for federal and state agencies to work effectively with the private sector. This year, we formed a CAES Industry Advisory Board to help develop a path forward for enhanced public-private partnerships. The Industry Advisory Board will provide guidance and assistance for how CAES, and its consortium members, can engage with industry partners and enable technologies to be commercialized.



### Industry Advisory Board

**Bill Bellamy**, CH2M HILL,  
Fellow & Sr. VP

**Paul Kjellander**,  
Idaho Public Utilities  
Commission,  
President

**Jay Larsen**, Idaho  
Technology Council,  
President & Founder

**Jeff Malmén**, IDACORP &  
Idaho Power,  
VP for Public Affairs

**Jim Nottingham**,  
LJ Enterprise  
(Hewlett-Packard),  
VP and General Manager

**Janine Rush-Byers**,  
Micron,  
University Relations  
Manager

**David Spurling**, Simplot,  
Sr. VP, Secretary, and  
General Counsel

**Raino Zoller**, Trailhead,  
Executive Director

## CAES Work with Industry in FY 15

Industry highlights from this year include:

### BSU's Energy Policy Institute collaborates with NuScale Power

The Center for Advanced Energy Studies' Energy Policy Institute (EPI) is working with NuScale Power, a developer of small modular nuclear reactors, to analyze the potential "economies of small" over the life cycle of a plant. EPI's David Solan and Dave Koehler are collaborating with BSU Economics Associate Professor Geoff Black and the University of Idaho's Fatih Aydogan (nuclear engineering) and Steven Peterson (economics) on the project.

### NanoSteel Co. uses MaCS for advanced steel testing

NanoSteel used the CAES Microscopy and Characterization Suite to elucidate basic structural features in the development of next generation Advanced High Strength Steel (AHSS). They used Atom Probe Tomography combined with advanced sample preparation using Focused Ion Beam (FIB) at MaCS to study the chemical hierarchy of nanoscale grains and grain boundaries.

### Accelerating Lab Impact – Lab-Corps Pilot Program

In 2014, the Department of Energy launched a \$2.3 million pilot program called Lab-Corps to accelerate the transfer of innovative clean energy technologies from the national laboratories into the commercial marketplace. CAES affiliate Idaho National Laboratory is one of seven laboratories participating in the Lab-Corps pilot program. INL selected two entrepreneurial teams, both

consisting of three people: a principal investigator, an entrepreneurial lead and an industry mentor. Each team focuses on one new technology.

INL's teams have the advantage of being able to tap into CAES universities. CAES members participating in Lab-Corps include Idaho State University's Small Business Development Center, Boise State University Venture College, and the Technology Deployment team at INL. This unique program allows the students working on the market assessments for the teams to get real-world experience and the INL teams to receive invaluable data.

### Autonomous Systems Center of Excellence Fosters Cooperation and Innovation

In 2015, CAES and the Idaho Department of Commerce established the Idaho Autonomous Systems Center of Excellence (ASCE, pronounced "ace").

ASCE was created to foster the swift development, deployment, and commercialization of technologies that advance the competitiveness of the region, especially in the area of agriculture technology. ASCE has already generated regional economic benefits and is driving new business, university, and government partnerships. ASCE is intent on using unmanned aerial systems to take regional agriculture to the next level of high-tech.

ASCE provides a range of products and services for unmanned aerial systems (UAS) developers, researchers and users in need of access to test ranges, facilities, and most importantly, the equipment and personnel to acquire, analyze and visualize large complex data sets.



ASCE PROVIDES A RANGE OF PRODUCTS AND SERVICES FOR UNMANNED AERIAL SYSTEMS (UAS) DEVELOPERS, RESEARCHERS, AND USERS.



## Publications, Presentations, & Proceedings

- Ajlavajhala, M. S., Y. Gonzalez-Velo, C. Poweleit, H. Barnaby, M. N. Kozicki, D. P. Butt, and M. Mitkova, 2014, "New Functionality of Chalcogenide Glasses for Radiation Sensing of Nuclear Waste," *Journal of Hazardous Materials* 269: 68-73.
- Ailavajhala, M. S., Y. Gonzalez-Velo, C. D. Poweleit, H. J. Barnaby, M. N. Kozicki, D. P. Butt, and M. Mitkova, 2014, "Thin Ge-Se Films as a Sensing Material for Radiation Doses," *Physica Status Solidi B* 251(7): 1347-1353.
- Ajlavajhala, M. S., Y. Gonzalez-Velo, C. Poweleit, H. Barnaby, M. N. Kozicki, K. Holbert, D. P. Butt, and M. Mitkova, 2015, "Unraveling the Gamma Radiation Induced Effects in Floppy and Rigid GeContaining Chalcogenide Thin Films," submitted to *Journal of Applied Physics*.
- Akbas, S., V. Martinez-Quiroga, F. Aydogan, C. Allison, and A. Ougouag, 2015, "Survey Coupling Schemes in Traditional Coupled Neutronics-Thermal-Hydraulics Codes," ASME 2015 International Mechanical Engineering Congress and Exposition, upcoming presentation *IMECE201552990*, Houston, Texas, November 13-19, 2015.
- Alanko, G. A., B. J. Jaques, A. Bateman, and D. P. Butt, 2014, "Mechanochemical Synthesis and Spark Plasma Sintering of Cerium Silicides," *Journal of Alloy Compounds* 616: 306-311.
- Alanko, G. A. and D. P. Butt, 2014, "Mechanochemical Synthesis of Cerium Monosulfide," *Journal of American Ceramic Society* 97(8): 2357-2359.
- Alanko, G. A. and D. P. Butt, 2014, "Mechanochemical Synthesis of Uranium Sesquioxide," *Journal of Nuclear Materials* 451: 243-248.
- Alanko, G. A., D. Osterberg, B. J. Jaques, M. Hurley, and D. P. Butt, 2015, "Kinetics of the Nitridation of Dysprosium During Mechanochemical Processing," *Journal of Alloy Compounds* 620: 413-420.
- Allahar, K. N., M. Hurley, E. Sapper, and D. P. Butt, 2014, "Simulation of the Relaxation Potential Profile of an ac-dc-ac Test," *International Journal of Corrosion* 1-12, 819476.
- Allahar, K. N., J. Burns, B. Jaques, Y. Q. Wu, I. Charit, J. Cole, and D. P. Butt, 2014, "Ferritic Oxide Dispersion Strengthen Alloys by Spark Plasma Sintering," *Journal of Nuclear Materials* 443(1-3): 256-265.
- Allahar, K., M. Hurley, E. Sapper, and D. P. Butt, 2015, "Interpretation of the Relaxation Potential Profile of an ac-dc-ac Test," accepted for publication in *Journal of Electrochemical Society*.
- Allahar, K. N., M. Shaltry, D. P. Butt, M. Simpson, S. Phongikaroon, and K. Bateman, 2015, "EIS and CV Methods for Monitoring SmCl<sub>3</sub> Concentration in Molten LiCl-KCl Eutectic," submitted to *Electrochemical Acta*.
- Allen, T. R., D. Kaoumi, J. P. Wharry, Z. Jiao, C. Topbasi, A. Kohnert, L. Barnard, A. Certain, K. Field, G. S. Was, D. L. Morgan, A. T. Motta, B. D. Wirth, and Y. Yang, 2015, "Characterization of Microstructure and Property Evolution in Advanced Cladding and Duct: Materials Exposed to High Dose and Elevated Temperature," *Journal of Materials Research* 30: 1246.
- Andrews, B. and G. P. Potirniche, 2014, "Explicit and Implicit Lifetime Assessment Methods of 9Cr1Mo Steel Under Combined Creep and Fatigue Loads Using a Strip Yield Model," *International Mechanical Engineering Congress and Exposition (IMECE2014)*, Toronto, Canada, November 14-20, 2014.
- Andrews, B. and G. P. Potirniche, 2015, "Constitutive Creep-Fatigue Crack Growth Methodology in Two Steels Using a Strip Yield Model," *Engineering Fracture Mechanics* 140: 72-91.
- Aydogan, F., G. Black, M. Black, and D. Solan, 2015, "Quantative and Qualitative Comparison of Light Water and Advanced Small Modular Reactors," *Journal of Nuclear Engineering and Radiation Science*, Nuclear Safety Special Issue, DOI: 10.1115/1.4031098.
- Aydogan, F. and G. Roth, 2015, "Six-Field Governing Equation Development for Advanced System Codes," 16<sup>th</sup> International Topical Meeting on Nuclear Reactor Thermalhydraulics (Nureth-16), 13089, Chicago, Illinois, August 30-September 4, 2015.
- Aydogan, F., 2015, "Coupling between RELAP5 and LabVIEW," Hacettepe University, March 12, 2015
- Aydogan, F., 2015, "More Conservative Governing Equations," Texas A&M, January 21-22, 2015.
- Aydogan, F., 2015, "New Developments in Nuclear Safety," in *International Nuclear Power Plants Summit*, March 19, 2015.
- Aydogan, F., 2015, "Space Reactors," Istanbul Technical University, May 5, 2015.
- Aydogan, F., J. Pack, and Z. Fu, 2015, "Qualitative and Quantitative Evaluation of Coupling Approaches for Coupling of RELAP and LabVIEW," *Nuclear Science and Engineering Journal*, RELAP5-3D Special Issue, NSE15-4.
- Aydogan, F. and G. Roth, 2015, "Development of Governing Equations Based on Six Fields for the RELAP Code," *Nuclear Science and Engineering Journal*, NSE14-149.
- Bartel N., M. Chen, V. P. Utgikar, X. Sun, I.-H. Kim, R. Christensen, and P. Sabharwall, 2015, "Comparison of Compact Heat Exchangers for Application as the Intermediate Heat Exchanger for Advanced Nuclear Reactors," *Annals of Nuclear Energy* 81: 143-149.
- Basirat, M., T. Shrestha, L. Barranyk, G. P. Potirniche, and I. Charit, 2015, "A Creep Damage Model for High-Temperature Deformation and Failure of 9Cr-1Mo Steel Weldments," *Metals* 5(3): 1487-1506, doi:10.3390/met5031487.
- Bian, J., J. Wu, R. Ubic, C. Karthik, and Y. Wu, 2015, "Structural Stability and Microwave Dielectric Properties of (1-x) Ba(Mg<sub>1/2</sub>W<sub>1/2</sub>)O<sub>3-x</sub>Ba(RE<sub>2/3</sub>W<sub>1/3</sub>)O<sub>3</sub> (RE = Sm, Dy, Y, Yb) Solid Solutions," *Journal of the European Ceramic Society* 35: 1431.
- Black, G., M. T. Black, D. Solan, and D. Shropshire, 2015, "Carbon Free Energy Development: A Decision Framework for the Deployment of Small Modular Nuclear Reactors," *Renewable and Sustainable Energy Reviews* 43(1): 83-94.
- Blay E.S., S. G. Schwabedissen, S. C. Reed, P. P. Sheridan, T. S. Magnuson, and K. A. Lohse, 2015, "Variation in Biological Soil Crust Bacterial Diversity with a Changing Climate," *Idaho Conference on Undergraduate Research 2015*, Boise, Idaho, July 29-30, 2015.
- Braine, T., B. J. Jaques, J. Watkins, and D. P. Butt, 2015, "Preparations for Hydrothermal Corrosion of Uranium Nitride Composite Fuels," *Idaho Conference on Undergraduate Research*, Boise, Idaho, July 30, 2015.
- Brewer, J., D. P. Ames, D. Solan, R. Lee, and J. Carlisle, 2015, "Using GIS Analytics and Social Preference Data to Evaluate Utility-Scale Solar Power Site Suitability," *Renewable Energy* 81: 825-836.
- Burns, J., Y. Wu, D. P. Butt, J. Taylor, K. Moser-McIntyre, 2015, "Vickers Hardness and Depth-Sensing Hardness in ODS Alloys," *TMS2015*, Orlando, Florida, March 15-19, 2015.
- Butt, D. P. and P. Price, 2014, "The Stability of Syngas Membrane Materials," University of Wyoming, Laramie, Wyoming, November 2014.

33. Butt, D. P. and J. Neri, 2014, "The Construction of Art and Artists," *da Vinci Dialogues*, Idaho Discovery Center, Boise, Idaho, November 2014.
34. Butt, D. P. and P. Price, 2014, "Phase Transformations and Expansion Behavior in Ca Substituted Lanthanum Ferrites," *MS&T Annual Meeting*, Pittsburgh, Pennsylvania, October 2014.
35. Butt, D. P., 2015, "Phase Transformations and Stability of Oxygen Ion Conducting Membranes for Syngas Production," Penn State University, Richard E. Tressler Lecture, March 2015.
36. Butt, D. P. and P. Price, 2015, "Thermochemical Stability of Lanthanum Orthoferrite, Oxygen Ion Conducting Materials," Imperial College, London, April 2015.
37. Butt, D. P. and B. J. Jaques, 2015, "Research Activities in Synthesis and Performance of Uranium Nitride-Based Nuclear (Composite) Fuels," *3<sup>rd</sup> Annual CARAT Meeting*, Hopkins, South Carolina, July 13, 2015.
38. Cárdenas, E. S., E. T. E. Reedy, H. A. Seipel, B. H. Failor, and A. W. Hunt, 2015, "Comparison of Fission Signatures from  $\beta$ -delayed  $\gamma$ -ray and Neutron Emissions," *Nuclear Instruments & Methods in Physics Research A* 792: 67.
39. Carlisle, J., S. Kane, D. Solan, M. Bowman, and J. Joe, 2015, "Public Attitudes Regarding Large-Scale Solar Energy Development in the US," *Renewable and Sustainable Energy Reviews* 48: 835–847.
40. Charit, I., S. Pasebani, Y. Wu, J. Burns, K. N. Allahar, D. P. Butt, and J. I. Cole, 2015, "Lanthana-Bearing Nanostructured Ferritic Steels via Spark Plasma Sintering: Microstructural Characteristics and Mechanical Behavior," submitted to *Journal of Nuclear Materials*.
41. Chen, W.-Y., Y. Miao, C. A. Tomchik, J. Gan, M. Okuniewski, Y. Q. Wu, S. A. Maloy, and J. F. Stubbins, 2014, "Microstructure and Mechanical Property Studies on Neutron-Irradiated Ferritic Fe-Cr Model Alloys," *The Nuclear Materials Conference (NuMat 2014)*, Hilton Clearwater, Florida, October 27–30, 2014.
42. Chen, M., I. Kim, X. Sun, R. N. Christensen, I. Skavdahl, V. Utgikar, and P. Sabharwall, 2014, "Preliminary Design of a Helical Coil Heat Exchanger for a Fluoride Salt-Cooled High-Temperature Test Reactor," *2014 ANS Winter Meeting*, Anaheim, California, November 2014.
43. Chen, W.-Y., Y. Miao, Y. Wu, C. A. Tomchik, K. Mo, J. Gan, M. A. Okuniewski, S. A. Maloy, and J. F. Stubbins, 2015, "Atom probe study of irradiation-enhanced  $\alpha'$  precipitation in neutron-irradiated Fe-Cr model alloys," *Journal of Nuclear Materials* 426: 242.
44. Chen, M., I. Kim, X. Sun, R. N. Christensen, V. Utgikar, and P. Sabharwall, 2015, "Transient Analysis of an FHR Coupled to a Helium Brayton Cycle," *Progress in Nuclear Energy* 83: 283–293.
45. Csarnovics, I., M. R. Latif, T. Nichol, W. Kuang, M. Mitkova, M. Veres, S. Kokenyesi, 2015, "Dual Effects of Photo-Darkening and Photo-Bleaching in Ge-Se Films," *Journal of Material Science and Engineering A* 5(1–20): 78–86.
46. Collins, J. A., G. P. Potirniche, and S. R. Daniewicz, 2015, "Failure Modes: Performance and Service Requirements for Metals," *Mechanical Engineers' Handbook: Materials and Mechanical Design*, 4th Edition, Volume 1, Editor: M. Kutz, Wiley.
47. Cutler, R., J. Lu, J. Mok, C. Deng, K. Smith, J. Zhang, and H. Xiong, 2015, "A Redox-Active Porous Organic Framework for Efficient Energy Storage in Na-ion Batteries," (poster) *MRS 2015 Spring Meeting*, San Francisco, California, April 2015.
48. Davis, B. C., L. Ward, D. P. Butt, B. Fillery, and I. Reimanis, 2015, "Fracture Strength and Principal Stress Field During Crush Testing of the SiC Layer in TRISO-Coated Fuel Particles," accepted for publication in *Journal Nuclear Materials*, in print.
49. Demkowicz, P. A., J. D. Hunn, R. N. Morris, C. A. Baldwin, J. M. Harp, P. L. Winston, S. A. Ploger, T. Gerczak, I. J. van Rooyen, F. C. Montgomery, and C. M. Silva, 2015, "Irradiation Performance of AGR-1 High Temperature Reactor Fuel," accepted for publication in *Nuclear Engineering and Design*.
50. Demkowicz, P. A., J. D. Hunn, R. N. Morris, C. A. Baldwin, J. M. Harp, P. L. Winston, S. A. Ploger, T. J. Gerczak, I. J. van Rooyen, F. C. Montgomery, and C. M. Silva, 2015, "Irradiation Performance of AGR-1 High Temperature Reactor Fuel," paper HTR2014-31182, to be published in *Proceedings of the 7th International Topical Meeting on High Temperature Reactor Technology (HTR2014)*, Weihai, China, October 27–31, 2014.
51. Demkowicz, P. A., J. D. Hunn, R. N. Morris, I. van Rooyen, T. Gerczak, J. M. Harp, S. A. Ploger, 2015, *AGR-1 Post Irradiation, Examination Final Report*, INL/EXT-15-36407, Idaho National Laboratory.
52. Dolph, C. K., D. J. Da Silva, and J. P. Wharry, 2015, "Effective Strain Hardening Coefficient for Irradiated 9 wt% Cr ODS Alloy by Nano-Indentation and TEM," *Materials Research Society Fall Meeting*, Boston, Massachusetts, scheduled for November 2015.
53. Duznik-Gougar, M. L., 2014, "Radionuclide Production in HTGR Graphite," *7th International Topical Meeting on High Temperature Reactor Technology (HTR2014)*, INET, Tsinghua University, Weihai, China, October 2014.
54. Duznik-Gougar, M. L., 2014, "Irradiated Graphite: Characterization and Treatment for Recycle or Disposal," seminar at INET, Tsinghua University, China, November 2014.
55. Duznik-Gougar, M. L., 2015, "The Basics of Radiation and Radioactivity," *ANS Congressional Seminar Series*, Washington, D.C., March 20, 2015.
56. Duznik-Gougar, M. L., 2015, "Radiation Conversations: Informing Consumers and Policy Makers," *ANS President's Special Session at 2015 Annual Meeting of the American Nuclear Society*, San Antonio, Texas, June 8, 2015.
57. Duznik-Gougar, M. L., I. J. van Rooyen, P. M. van Rooyen, and C. M. Hill, 2015, "Effects of CVD Production Parameters and Annealing on the Grain Characteristics of a Thin Silicon Carbide Layer," *Journal of Nuclear Materials*, submitted September 2015.
58. Duznik-Gougar, M. L., I. J. van Rooyen, C. M. Hill, T. Trowbridge, J. Madden, and J. Burns, "Effect of Sample Preparation Techniques on Grain Boundary Characterization of Annealed TRISO-Coated Particles," *Nuclear Technology*, submitted September 2015.
59. Dutt, A. K., S. Pasebani, I. Charit, and R. S. Mishra, 2015, "Microstructural Optimization of High Temperature Ni-Cr ODS Alloy Using Genetic Algorithm," *Computational Modeling and Stochastic Methods for Materials Discovery and Properties, TMS Annual Meeting and Exhibition*, Orlando, Florida, March 15–19, 2015.
60. Fu, Z., F. Aydogan, and R. J. Wagner, 2015, "Conservative Conservation Equations: Numerical Approach and Code-to-Code Benchmarks," *Journal of Progress in Nuclear Energy* 81: 169–183.
61. Fu, Z., F. Aydogan, and R. J. Wagner, 2015, "More Conservative Governing Equations in RELAP5: Derivation of Equations," *Annals of Nuclear Energy* 85: 523–531.
62. Gallagher, J. R., T. Li, H. Zhao, J. Liu, Y. Lei, X. Zhang, Y. Ren, J. W. Elam, R. J. Meyer, R. E. Winans, and J. T. Miller, 2014, "In Situ Diffraction of Highly Dispersed Supported Platinum Nanoparticles," *Catalysis Science & Technology* 4(9): 3053–3063.
63. Gallagher, J. R., D. J. Childers, H. Zhao, R. E. Winans, R. J. Meyer, and J. T. Miller, 2015, "Structural Evolution of an Intermetallic Pd-Zn Catalyst Selective for Propane Dehydrogenation," *Physical Chemistry Chemical Physics* 42: 28144–28153.

64. George, J., L. D. Owen, T. Xing, D. M. McEligot, J. C. Crepeau, R. S. Budwig, and K. P. Nolan, 2014, "Entropy Generation in Bypass Transitional Flows," *Journal of Hydrodynamics* 26: 669–680.
65. Ghasemi, E., D. M. McEligot, K. P. Nolan, J. Crepeau, A. Siahpush, R. S. Budwig, and A. T. Tokuhiro, 2014, "Effects of Adverse and Favorable Pressure Gradients on Entropy Generation in a Transitional Boundary Layer Region Under the Influence of Freestream Turbulence," *International Journal of Heat Mass Transfer* 77: 475–488.
66. Guillen, D. P., 2015, "Radiation Effects on the Thermophysical Properties of a New Neutron Absorbing Material," *2015 TMS Annual Meeting*, Orlando, Florida, March 15-19, 2015.
67. Guillen, D. P., 2015, "Development of a Metal Matrix Composite Material for Nuclear Reactor Applications," *2015 TMS Annual Meeting*, Orlando, Florida, March 15–19, 2015.
68. Guillen, D. P., 2015, "Characterization and Modeling of a New Material for Nuclear Reactor Applications," *Materials Modeling, Simulation and Visualization Workshop*, McCall, Idaho, May 13-14, 2015.
69. Guria, A. and I. Charit, 2015, "Observation of Serrated Flow in APMTM Alloy," *Materials Letters* 160: 55–57.
70. Guria, A., I. Charit, and B. Petrovic, 2015, "Tensile Deformation Behavior of Al-Rich Ferritic Steels for Advanced Light Water Reactors," *FIMPART 2015, International Conference on Frontiers in Materials Processing, Applications Research and Technology*, Hyderabad, June 12–15, 2015.
71. Harris, J. T., 2014, "Nuclear Energy and Security," *Naval Post Graduate School Energy Academic Group Seminar Series*, Monterey, California, November 14, 2014.
72. Harris, J. T., 2014, "International Nuclear Security Education Network (INSEN): Structure, Accomplishments, and Lessons Learned," *United Nations 1540 Committee*, United Nations, New York, New York, November 17, 2014.
73. Harris, J. T., 2015, "IAEA Radiation Source Controls in the Era of Global Terrorist Threats," *2015 NATC ISOE ALARA Symposium*, Ft. Lauderdale, Florida, January 11, 2015.
74. Harris, J. T., 2015, "Materials and Resources for Nuclear Security Education (including online resources)," *PNS and KCL Advanced Nuclear Security Curriculum Design Workshop*, Vienna, Austria, February 23–24, 2015.
75. Harris, J. T., 2015, "Assessing the Effect of INSEN Activities on Nuclear Security Education," *2015 International Nuclear Security Education Network (INSEN) Working Group Meeting*, Vienna, Austria, February 25–27, 2015.
76. Harris, J. T., 2015, "Securing Nuclear Materials: Destructive Analysis and Non-Destructive Assay," *U.S. Department of State PNS Webinar series*, Pandit Deendayal Petroleum University, India, April 16, 2015.
77. Harris, J. T., 2015, "Nuclear Security: Detection of Unauthorized Acts Involving Nuclear/Radiological Materials," *U.S. Department of State PNS Webinar series*, University of the Witwatersrand, South Africa, April 21, 2015.
78. Harris, J. T., 2015, "Nuclear Security: Threats and Terrorism," *U.S. Department of State PNS Webinar series*, Gadjah Mada University, Indonesia, May 5, 2015.
79. Harris, J. T., 2015, "Nuclear Security: Teaching Methods, Design Basis Threat, and Curriculum Development," *Department of State PNS and University of Georgia CITS Nuclear Security Curriculum Development Workshop*, Vienna, Austria, May 12–15, 2015.
80. Hawkley, G., J. Whicker, and J. Harris, 2015, "Observations on Using Inside Air Concentrations as a Predictor of Outside Air Concentrations," *Health Physics* 108(4): 465–468.
81. Heath, B. and F. Aydogan, 2015, "Effects of Corrosion on Emissivity in the PEWEE Nuclear Rocket," *International Conference on Aerospace and Mechanical Engineering 2015 (ICAME'15)*, Kollam, Kerala, India, December 14–16, 2015.
82. Heath, B. and F. Aydogan, 2015, "Radiation Heat Transfer in the Fuel of Nuclear Rocket," submitted to *Journal of Thermal Engineering*.
83. Hill, C. D., S. Sitler, I. Charit, and K. S. Raja, 2015, "Processing and Characterization of ZrB<sub>2</sub>-HfB<sub>2</sub> Solid Solutions for Magneto-hydrodynamic (MHD) Applications," *11th International Conference on Ceramic Materials and Components for Energy and Environmental Applications*, Vancouver, Canada, June 14–19, 2015.
84. Hiromoto, R. E., 2015, "Parallelism and Complexity of the Small World Model," *The 8th IEEE International Conference on Intelligent Data Acquisition and Advanced Computing Systems: Technology and Applications*, Warsaw, Poland, September 24–26, 2015.
85. Hiromoto, R. E. and T. Veluppillai, 2015, "A Tablet-Class Cloud Architecture for Remote Execution and Interactive Data Analysis," *The 8th IEEE International Conference on Intelligent Data Acquisition and Advanced Computing Systems: Technology and Applications*, Warsaw, Poland, September 24–26, 2015.
86. Hunt, A., 2014, "Determining isotopic concentration using delayed grays from active inspection techniques for nuclear materials safeguards and maybe other applications," colloquium speaker at Idaho State University's Department of Physics, Pocatello, Idaho, November 17, 2014.
87. Idaho National Laboratory, 2015, "Autonomous Systems Center of Excellence Fosters Cooperation and Innovation," *Federal Laboratories and State and Local Governments: Partners for Technology Transfer Success*, Federal Laboratory Consortium, 2015, pp.10-11.
88. Jaques, B. J., G. A. Alanko, P. Xu, E. J. Lahoda, and D. P. Butt, 2014, "Synthesis of Advanced Multiphase Actinide Fuels," *Materials Science and Technology 2014 Conference*, Pittsburgh, Pennsylvania, October 12–16, 2014.
89. Jaques, B. J., G. A. Alanko, S. Tamrakar, J. Kane, and D. P. Butt, 2014, "Cerium Monosulfide: Novel Synthesis Method and Oxidation Behavior," *Materials Science and Technology 2014 Conference*, Pittsburgh, Pennsylvania, October 12-16, 2014.
90. Jaques, B. J. and D. P. Butt, 2015, "Synthesis of accident tolerant nitride fuels," *Global 2015: Nuclear Fuel Cycle for a Low Carbon Future*, Paris, France, September 21–24, 2015.
91. Jaques, B. J. and D. P. Butt, 2015, "High Temperature Oxidation Kinetics of Dysprosium Particles," *Journal of Alloys and Compounds* 644: 211–222.
92. Jaques, B. J., D. D. Osterberg, M. F. Hurley, C. R. Cole, S. Tamrakar, and D. P. Butt, 2015, "In Situ Characterization of the Kinetics of Nitridation of Dysprosium During High Energy, Reactive Milling," *Journal of Alloys and Compounds* 619: 253–261.
93. Jaques, B. J., J. Watkins, J. Croteau, G. Alanko, B. Tyburska-Puschel, M. Meyer, P. Xu, E. Lahoda, and D. P. Butt, 2015, "Synthesis and Sintering of UN-UO<sub>2</sub> Composite Fuel," accepted for publication in *Journal of Nuclear Materials*.
94. Johnson, A., C. Puschak, J. A. Wilson, and T. S. Magnuson, 2015, "Extracellular electron transport in Thermus," *115th General Meeting American Society for Microbiology*, New Orleans, Louisiana, October 12–16, 2014.



95. Kamath, G., R. Cutler, S. Deshmukh, M. Shakourian-Fard, R. Parish, J. Huether, D. P. Butt, C. Xiong, and S. Sankaranarayanan, 2014, "In Silico Based Rank-Order Determination and Experiments on Non-Aqueous Electrolytes for Sodium Ion Battery Applications," *Journal of Physical Chemistry C* 118(25): 13406-13416.
96. Karthik, C., J. Kane, D. P. Butt, W. E. Windes, and R. Ubig, 2015, "Neutron Irradiation Induced Microstructural Changes in NBG-18 and IG-110 Nuclear Graphites," *Carbon* 86: 124-131.
97. Khafizov, M., J. Pakarinen, L. He, H. Henderson, M. Manuel, A. Nelson, B. Jaques, D. P. Butt, and D. Hurley, 2015, "Subsurface Imaging of Grain Microstructure Using Picosecond Ultrasonics," submitted to *Acta Materialia*.
98. Kim, K., G. Whelan, T. Purucker, T. Bohrmann, M. Cyterski, M. Molina, Y. Gu, Y. Pachepsky, A. Guber, and D. Franklin, 2014, "Rainfall-Runoff Model Parameter Estimation and Uncertainty Evaluation on Small Plots," *Hydrological Processes* 28: 5220-5235, doi: 10.1002/hyp.10001.
99. Kyne, D. and J. Harris, 2014, "Development of a Nuclear Power Plant Potential Risk Index (NPP PRI)," *HPS Annual Meeting*, Baltimore, Maryland, July 12-17, 2014.
100. LaBrier, D. P. and M. L. Dunzik-Gougar, 2015, "Identification and Location of 14C-bearing Species in Thermally Treated Neutron Irradiated Graphites NBG-18 and NBG-25: Pre and Post-Thermal Treatment," *Journal of Nuclear Materials* 460: 174-183.
101. Leng, B., I. van Rooyen, Y. Wu, I. Szlufarska, and K. Sridharan, 2015, "STEM/EDS Analysis of Fission Products in Irradiated TRISO-Coated Particles of the AGR-1 Experiment," accepted for publication to *Journal of Nuclear Materials*, October 2015.
102. Lester, K., N. Leraas, B. J. Jaques, and D. P. Butt, 2015, "High Temperature Oxidation Kinetics of Dysprosium," *12th Annual Boise State University Undergraduate Research Conference*, Boise, Idaho, April 20, 2015.
103. Li, L., 2015, "Metal-Organic Frameworks (MOFs): Energy and Informatics," (co-editor) special issue, *Open Access Journal Crystals*.
104. Li, L., 2015, "Carbon Dioxide Sorption in Octahedral Molecular Sieve Materials," *2015 MS&T*, Columbus, Ohio, October 2015.
105. Li, L., 2015, "Materials Theory and Modeling Research and Education," Brewer Science Inc., February 2015.
106. Li, L., 2015, "Structures and Thermoelectric Properties of Double-Filled Skutterudites," *TMS Annual Meeting and Exhibition*, Orlando, Florida, March 2015.
107. Li, L., 2015, "ICME Training in Materials Science and Engineering Curriculum," *3rd World Congress on Integrated Computational Materials Engineering*, Colorado Spring, Colorado, May 2015.
108. Li, L., 2016, "First-Principles Investigation on Improving Thermoelectric Materials," *2016 TMS*, Nashville, Tennessee, scheduled for February 2016.
109. Li, Z., W.-Y. Lo, Y. Chen, J. Pakarinen, Y. Wu, T. Allen, and Y. Yang, 2015, "Irradiation response of delta ferrite in as-cast and thermally aged cast stainless steel," *Journal of Nuclear Materials* 466: 201.
110. Lillo, T. M. and I. J. van Rooyen, 2015, "Associations of Pd, U and Ag in the SiC Layer of Neutron Irradiated TRISO Fuel," *Journal of Nuclear Materials* 460: 97-106.
111. Lillo, T. M., I. J. van Rooyen, and Y. Wu, 2015, "Grain Boundary Character and Fission Product Precipitation in SiC," *Proceedings of the 2015 ANS Annual Meeting*, San Antonio, Texas, June 7-11, 2015.
112. Lillo, T. M. and I. J. van Rooyen, 2015, "Influence of SiC Grain Boundary Character on Fission Product Transport in TRISO Fuel," submitted to the *Journal of Nuclear Materials*, September 2015.
113. Lillo, T. M. and I. J. van Rooyen, 2015, "Precession Electron Diffraction for SiC Grain Boundary Characterization in Unirradiated TRISO Fuel," submitted to *Nuclear Engineering and Design*, September 2015.
114. Lysne, D. P., S. Acharya, V. Patel, B. J. Jaques, S. M. Loo, M. F. Hurley, and D. P. Butt, 2015, "Development of a Novel Sensor to Detect Stress Corrosion Cracking of Spent Nuclear Fuel Storage Containers," *NACE International Corrosion Conference*, Dallas, Texas, March 15-19, 2015.
115. Lysne, D. P., S. Acharya, V. Patel, B. J. Jaques, S. M. Loo, M. F. Hurley, and D. P. Butt, "Development of a Novel Sensor to Detect Stress Corrosion Cracking of Spent Nuclear Fuel Storage Containers," *12th Annual Boise State University Undergraduate Research Conference*, Boise, Idaho, April 20, 2015.
116. Magnuson, T. S., A. Johnson, A. Gordon, and K. Counsell, 2014, "Multi-Extreme Microbial Environments of Idaho," *International Symposium on Subsurface Microbiology*, Pacific Grove, California, October 2014.
117. Magnuson, T. S. et al., 2015, "Manure Biochemistry and Microbiology," *WIDE Dairy Industry Workshop*, Boise, Idaho.
118. Mairov, A., J. He, and K. Sridharan, 2015, "Structural Effects in Oxide Dispersion Strengthened (ODS) Steel Neutron Irradiated to 3 dpa at 500°C," *Microscopy and Microanalysis (M&M) 2015 Meeting*, University of Wisconsin-Madison, Portland, Oregon, August 2-6, 2015.
119. Mairov, A., J. He, and K. Sridharan, 2015, "Structural Effects in Oxide Dispersion Strengthened (ODS) Steel Neutron Irradiated to 3 dpa at 500°C," *Microscopy and Microanalysis* 21(3): 757-758, doi:10.1017/S1431927615004584.
120. Martinez-Quiroga, V., S. Akbas, F. Aydogan, C. Allison, and A. Ougouag, 2015, "Coupling of RELAP5-SCDAP Mod4.0 and Neutronic Codes," *ASME 2015 International Mechanical Engineering Congress and Exposition*, upcoming presentation IMECE2015-52991, Houston, Texas, November 13-19, 2015.
121. McEligot, D. M. and E. J. Walsh, 2014, "Entropy Generation in Steady Laminar Boundary Layers with Pressure Gradients," *Entropy* 16: 3808-3813.
122. McEligot, D. M. and E. Laurien, 2015, "Insight from Simple Heat Transfer Models," paper ISSCWR72023, *7th International Symposium on Supercritical Water-Cooled Reactors*, Helsinki, Finland, March 2015.
123. McJunkin, T. R., C. G. Rieger, B. K. Johnson, D. S. Naidu, L. H. Beaty, J. F. Gardner, I. Ray, K. L. LeBlanc, and M. Guryan, 2015, "Interdisciplinary Education through 'Edu-tainment': Electric Grid Resilient Control Systems Course," *ASME Annual Conference and Exposition* <https://www.asme.org/public/conferences/56/papers/12942/view#sthash.dnTDEcle.dpuf>.
124. Mi, H., S. Mikael, T. Allen, K. Sridharan, D. P. Butt, J. P. Blanchard, and Z. Ma, 2014, "Monitoring the Oxidation of Nuclear Fuel Cladding Using Raman Spectroscopy," *Journal of Nuclear Materials* 445: 7-11.
125. Mi, H., S. Mikael, T. Allen, K. Sridharan, D. P. Butt, S. Gong, J. P. Blanchard, and Z. Ma, 2015, "Detection of Oxidation of Zircaloy-4 Claddings in Dry Storage by Infrared Interference," submitted to *Journal of Nuclear Materials*.
126. Mishchenko, A., J. Berashevich, K. Wolf, D. A. Tenne, A. Reznik, and M. Mitkova, 2015, "Dynamic Variations Of The Light-Induced Effects In A-Ge X Se 100-X Films: Experiment And Simulation," *Optical Materials Express* 5(2): 295-306.
127. Mitkova, M., 2015, "X-rays and Particle Interactions with Chalcogenide Glasses," *Amorphous and Nanocrystalline Chalcogenides (ANC) 7*, Cluj, Romania, July 5-10, 2015.

128. Mitkova, M., M. S. Ailavajhala, Y. Gonzalez-Velo, C. D. Poweleit, H. J. Barnaby, M. N. Kozicki, and D. P. Butt, 2015, "New Functionality of Chalcogenide Glasses for Radiation Sensing of Nuclear Waste," submitted to *Science Total Environment*.
129. Mitkova, M., M. Ailavajhala, D. P. Butt, H. Barnaby, Y. Gonzalez Velo, and C. Poweleit, 2015, "Investigation of the Structure and Performance of CMOS Compatible Lateral Radiation Sensors using Thin Film Chalcogenide Glasses," submitted to *Canadian Journal of Physics*.
130. Moran, M. and J. T. Harris, 2015, "Advanced Curriculum Design Concepts: Research-Led Teaching and Microteaching," *PNS and KCL Advanced Nuclear Security Curriculum Design Workshop*, Vienna, Austria, February 23–24, 2015.
131. Munoz, B., S. Raoux, J. Jordan-Sweet, and D. P. Butt, 2015, "A Combinatorial Analysis of Several Phase Change Alloys Via Laser-Induced Transformations for Non-Volatile Memory Applications," submitted to *Journal of Applied Physics*.
132. Munoz, B., S. Raoux, J. Jordan-Sweet, and D. P. Butt, 2015, "Crystallization Characteristics of Thermally-Induced Phase Transformations of Chalcogenide Alloys for Non-Volatile Memory Applications," submitted to *Journal of Applied Physics*.
133. Nandanwar, S. U., K. Coldsnow, M. Green, V. Utgikar, P. Sabharwall, and E. Aston, 2014, "Treatment of Radioactive Contaminants in Off-Gases Using Carbon Supported ETS-10 Nanosorbent," *2014 ANS Winter Meeting*, Anaheim, California, November 2014.
134. Nandanwar, S. U., V. Utgikar, P. Sabharwall, D. E. Aston, and K. Coldsnow, 2015, "Krypton Removal from the Off-Gas Stream using the Hollow Carbon Based Nanosorbent," *2015 Annual Meeting of the American Nuclear Society*, San Antonio, Texas, June 2015.
135. Nandanwar, S. U., K. Coldsnow, V. Utgikar, P. Sabharwall, D. E. Aston, and S. Bose, 2015, "Synthesis and Characterization of ETS-10 - Supported Hollow Carbon Nano-Polyhedrons Nanosorbent for Adsorption of Krypton at Near Ambient Temperatures," accepted for publication *Adsorption*.
136. Nielsen, J., A. Tokuhira, R. E. Hiromoto, and L. Tu, 2015, "Branch-and-Bound Algorithm Applied to Uncertainty Quantification of a Boiling Water Reactor Station Blackout," accepted for publication *Nuclear Engineering and Design*.
137. Nykorak, A., R. E. Hiromoto, and A. Sachenko, 2015, "A Wireless Navigation System with No External Positions," *The 8th IEEE International Conference on Intelligent Data Acquisition and Advanced Computing Systems: Technology and Applications*, Warsaw, Poland, September 24–26, 2015.
138. Odette, G. R., T. Yamamoto, P. B. Wells, and N. Almirall, 2015, "Integrated Models and Experiments for Robust Predictions of RPV Steel High Fluence-Low Flux Irradiation Embrittlement," *MRS Spring Meeting 2015*, San Francisco, California, April 5–9, 2015.
139. Pack, J., Z. Fu, and F. Aydogan, 2015, "Modeling Primary and Secondary Coolant of a Nuclear Power Plant System with a Unique Framework (MCUF)," *Progress in Nuclear Energy* 83: 197–211.
140. Pack, J. and F. Aydogan, 2015, "Small-Break Loss of Coolant Accident Prediction with MCUF (Modeling Primary and Secondary Coolant of a Nuclear Power Plant System with a Unique Framework) and a Realistic Secondary Coolant System Design," *Progress in Nuclear Energy* 83: 197–211.
141. Parish, C. M., K. G. Field, A. G. Certain, and J. P. Wharry, 2015, "Application of STEM characterization for investigating radiation effects in BCC Fe-based alloys," *Journal of Materials Research* 30: 1275.
142. Parrish, R., E. Dufek, and H. Xiong, 2015, "Electrolyte Performance for Na-ion Batteries," *ACS 2015 Northwest Regional Meeting*, Pocatello, Idaho, June 2015.
143. Parrish, R., R. Cutler, G. Kamath, E. Dufek, S. K. R. S. Sankaranarayanan, and H. Xiong, 2015, "Understanding Electrode/electrolyte Solution Interactions between TiO<sub>2</sub> Nanotube Electrode and Nonaqueous Electrolytes for Sodium-ion Batteries," *2015 TMS Annual Meeting and Exhibition*, Orlando, Florida, March 2015.
144. Pasebani, S., I. Charit, D. P. Butt, J. I. Cole, Y. Q. Wu, and J. Burns, 2015, "Effect of Milling Time on the Densification Behavior of a Lanthana-Bearing Nanostructured Ferritic Steel Consolidated via Spark Plasma Sintering," submitted to *Journal of Material Processing*.
145. Pasebani, S., I. Charit, Y. Q. Wu, J. Burns, K. N. Allahar, D. P. Butt, and J. I. Cole, 2015, "Spark Plasma Sintering of Lanthana-Bearing Nanostructured Ferritic Steels," submitted to *Metallurgical Transactions A*.
146. Pasebani, S., I. Charit, Y. Wu, J. Burns, K. Allahar, D. P. Butt, and J. I. Cole, 2015, "Effects of Spark Plasma Sintering Parameters on the Microstructural Evolution and Mechanical Properties of a Lanthana-Bearing Nanostructured Ferritic Steel," submitted to *Materials Chemistry and Physics*.
147. Pasebani, S., A. K. Dutt, J. Burns, I. Charit, and R. S. Mishra, 2015, "Oxide Dispersion Strengthened Nickel Based Alloys via Spark Plasma Sintering," *Journal of Materials Science and Engineering A* 630: 155–169, doi:10.1016/j.msea.2015.01.066.
148. Pasebani, S., I. Charit, J. Burns, S. Alsagabi, D. P. Butt, J. I. Cole, L. M. Price, and L. Shao, 2015, "Microstructural Stability of a Self-Ion Irradiated Lanthana-Bearing Nanostructured Ferritic Steel," *Journal of Nuclear Materials* 462: 191–204.
149. Pasebani, S., I. Charit, D. P. Butt, J. I. Cole, Y. Q. Wu, and J. Burns, 2015, "Sintering Behavior of Lanthana-Bearing Nanostructured Ferritic Steel Consolidated via Spark Plasma Sintering," *Advanced Engineering Materials*, in press.
150. Pasebani, S., A. Guria, J. Burns, Y. Wu, I. Charit, D. P. Butt, J. Cole, L. Shao, and L. Price, 2016, "Microstructural and Nanomechanical Characteristics of an Ion-Irradiated Lanthana-Bearing Nanostructured Ferritic Steel," *TMS2016*, Nashville, Tennessee, February 14–18, 2016.
151. Potirniche, G. P., 2015, "Simulations of Creep-Fatigue Crack Growth in Steels Using Strip-Yield and Microstructure-Based Constitutive Modeling," *3rd ECCOMAS Young Investigators Conference /6th German Association of for Computational Mechanics Colloquium on Computational Mechanics (YIC GACM 2015)*, Aachen, Germany, July 20–24, 2015.
152. Prabhakaran, R., Y. Q. Wu, J. Burns, J. Cole, I. Charit, R. S. Mishra, and K. L. Murty, "Neutron Irradiation Studies on Friction Stir Processed ODS," *TMS2015*, Orlando, Florida, March 15–19, 2015.
153. Price, L., L. Shao, Y. Wu, J. Burns, J. Cole, and D. P. Butt, 2014, "Microstructure and Mechanical Properties of Ion Irradiated Lanthanum-Bearing Nanostructured Ferritic Steels," *MS&T Annual Meeting*, Pittsburgh, Pennsylvania, October 2014.
154. Price, P., E. Rabenberg, D. Thomsen, S. T. Mixture, and D. P. Butt, 2014, "Phase Transformations in Calcium-Substituted Lanthanum Ferrite," *Journal of American Ceramic Society* 97(7): 2241–2248.
155. Price, P. M., N. Browning, and D. P. Butt, 2015, "Microdomain Formation, Oxidation, and Cation Ordering in LaCa<sub>2</sub>Fe<sub>3</sub>O<sub>8+y</sub>," *Journal of American Ceramic Society* 98(7): 2248–2254.
156. Price, P. M. and D. P. Butt, 2015, "Stability and Decomposition of Ca Substituted Lanthanum Ferrite in Reducing Atmospheres," *Journal of American Ceramic Society* 98(9): 2881–2886.
157. Rabenberg, E. M., K. Knori, B. J. Jaques, B. H. Spencer, F. A. Garner, P. D. Freyer, and D. P. Butt, 2014, "Influence of Irradiation Damage and Temperature on the Strength of 304SS," *Journal of Nuclear Materials* 448: 315–324.
158. Rajabi, S., M. Saremi, H. J. Barnaby, A. Edwards, M. N. Kozicki, and M. Mitkova, 2015, "Static Impedance Behavior Of Programmable Metallization Cells," *Solid-State Electronics* 106: 27–33.
159. Rane, S., J. Harris, and V. Starovoitova, 2015, "<sup>47</sup>Ca Production for <sup>47</sup>Ca/<sup>47</sup>Sc Generator System Using Electron Linacs," *Applied Radiation and Isotopes* 97: 188–192.
160. Roth, G. A. and F. Aydogan, 2015, "Derivation of New Mass, Momentum, and Energy Conservation Equations for Two-Phase Flows," *Progress in Nuclear Energy* 80: 90–101.
161. Roth, G. A. and F. Aydogan, 2015, "Momentum and Energy Closure Models for Two-Phase Flow Six-Field Model," submitted to *Nuclear Engineering and Design Journal*.
162. Roth, G. A. and F. Aydogan, 2015, "Mass Closure Models for Two-Phase Flow Six-Field Model," submitted to *Nuclear Engineering and Design*.

163. Sakaguchi, Y., H. Asaoka, Y. Uozumi, Y. Kawakita, T. Ito, M. Kubota, D. Yamazaki, K. Soyama, M. Ailavajhala, K. Wolf, M. Mitkova, and M. W. A. Skoda, 2015, "Measurement of Transient Photo-Induced Changes in Thin Films at J-PARC—Time-Resolved Neutron Reflectivity Measurements of Silver Photo-Diffusion into Ge-Chalcogenide Films," *2nd International Symposium on Science at J-PARC—Unlocking the Mysteries of Life, Matter and the Universe*, Tokyo, Japan, March 10–14, 2015.
164. Sakaguchi, Y., H. Asaoka, Y. Uozumi, Y. Kawakita, T. Ito, and M. Kubota, 2015, "Dynamics of silver photo-diffusion into Ge-chalcogenide films: time-resolved neutron reflectometry," *Journal of Physics: Conference Series* 619(1): 012046.
165. Schwabedissen, S. G., S. C. Reed, T. S. Magnuson, and K. A. Lohse, 2014, "Biological Soil Crust Nitrogen Fixation in Semi-arid Ecosystems: Climatic and Grazing Controls," (poster) *All Hands Critical Zone Observatory Network*, Fish Camp, California, September 21–24, 2015.
166. Schwabedissen, S. G., S. C. Reed, P. P. Sheridan, T. S. Magnuson, and K. A. Lohse, 2014, "Climatic and Grazing Controls on Biological Soil Crust Nitrogen Fixation in Semi-Arid Ecosystems," (poster) *American Geophysical Union Fall Meeting 2014*, San Francisco, California, December 14–19, 2014.
167. Shrestha, T., S. F. Alsagabi, I. Charit, G. P. Potimiche, and M. V. Glazoff, 2015, "Effect of Heat Treatment on the Mechanical Properties of Modified 9Cr-1Mo Steel," *Metals* 5(1): 131–149, doi:10.3390/met5010131.
168. Skavdahl, I., V. Utgikar, P. Sabharwall, M. Chen, X. Sun, I.-H. Kim, and R. N. Christensen, 2014, "Transient Analysis of Advanced High Temperature Reactors Using Process Simulation Software," *2014 ANS Winter Meeting*, Anaheim, California, November 2014.
169. Skavdahl, I., V. Utgikar, P. Sabharwall, M. Chen, X. Sun, and R. Christensen, 2015, "Control Strategy Development of Advanced High Temperature Reactor System," *2015 Annual Meeting of the American Nuclear Society*, San Antonio, Texas, June 2015.
170. Skifton, R. S., 2015, "Entropy generation for a bypass transitional boundary layer and improved particle image velocimetry measurements using particle density information," Ph.D. dissertation, University of Idaho, July 2015.
171. Smith, S. A., E. Hughes, E. R. Coats, C. K. Brinkman, A. G. McDonald, J. Harper, K. Feris, and D. Newby, 2015, "Toward Sustainable Dairy Waste Utilization: Enhanced VFA and Biogas Synthesis via Upcycling Algal Biomass Cultured on Waste Effluent," *Journal of Chemical Technology Biotechnology* published online, DOI 10.1002/jctb.4706.
172. Spaulding, B., B. J. Jaques, T. Lamansky, and D. P. Butt, 2015, "Mechanical Degradation of Commercial Fish Hooks using a Novel Approach," *12th Annual Boise State University Undergraduate Research Conference*, Boise, Idaho, April 20, 2015.
173. Spaulding, B., A. Wirtz, K. Lester, J. Watkins, B. J. Jaques, K. Koller, and D. P. Butt, 2015, "Mechanical Strength of SiC Fibers," *12th Annual Boise State University Undergraduate Research Conference*, Boise, Idaho, April 20, 2015.
174. Sprouster, D. J., J. Sinsheimer, E. Dooryhee, S. K. Ghose, P. B. Wells, T. Stan, N. Almirall, G. R. Odette, and L. E. Ecker, 2015, "Structural Characterization of Nanoscale Intermetallic Precipitates in Highly Neutron Irradiated Reactor Pressure Vessel Steels," accepted for publication in *Scripta Materialia*.
175. Sullivan, K., M. Cyterski, S. Kraemer, C. Knights, K. Price, K. Kim, L. Prieto, M. Gabriel, and R. Sidle, 2015, "Case Study Analysis of the Impacts of Water Acquisition for Hydraulic Fracturing on Local Availability," EPA/600/R-14/179, U.S. Environmental Protection Agency, Washington, D.C.
176. Sundararajan, J. A., M. Kaur, J. Burns, Y. Q. Wu, T. Schimeland, and Y. Qiang, 2015, "Cr-Doping and Heat-Treatment Effect on Core-Shell Ni Nanocluster Film," submitted to *Journal of Physics D: Applied Physics*.
177. Swenson, M. J. and J.P. Wharry, 2015, "The Strengthening Mechanism Transition in Nanofeatured Ferritic-Martensitic Alloys," *The Minerals, Metals and Materials Society Annual Meeting*, Orlando, Florida, March 2015.
178. Swenson, M. J. and J. P. Wharry, 2015, "The Comparison of Microstructure and Nanocluster Evolution in Proton and Neutron Irradiated Fe-9%Cr ODS Steel to 3 dpa at 500°C," *Journal of Nuclear Materials* 467: 97.
179. Utgikar, V. P, D. E. Aston, P. Sabharwall, S. Nandanwar, K. Coldsnow, and M. Green, 2015, "Off-Gas Treatment: Evaluation of Nano-structured Sorbents for Selective Removal of Contaminants," *Materials Recovery and Waste Form Campaign Working Group Meeting*, Savannah River National Laboratory, Aiken, South Carolina, February 2015.
180. Valderrama, B., L. He, H. B. Henderson, J. Pakarinen, B. Jaques, J. Gan, D. P. Butt, T. R. Allen, and M. V. Manuel, 2014, "Effect of Grain Boundaries on Krypton Segregation Behavior in Irradiated Uranium Dioxide," *Journal of the Minerals, Metals, and Materials Society* 66(12): 2562–2568.
181. Valentin, F. I., N. Artoun, M. Kawaji, and D. M. McEligot, 2015, "Experimental Study of Forced Convection Heat Transfer During Upward and Downward Flow of Helium at High Pressure and High Temperature," paper TFSEC-12797, *1st Thermal and Fluid Engineering Summer Conference*, New York, August 2015.
182. Valentin, F. I., N. Artoun, M. Kawaji, and D. M. McEligot, 2015, "Investigation of Helium Flow Laminarization at High Temperature and High Pressures in a Graphite Flow Channel," paper TFSEC12872, *1st Thermal and Fluid Engineering Summer Conference*, New York, August 2015.
183. Vandegrift, J., P. Price, I. J. van Rooyen, and D. P. Butt, 2015, "High Temperature Oxidation of Zirconium Alloys," *12th Annual Boise State University Undergraduate Research Conference*, Boise, Idaho, April 20, 2015.
184. van Rooyen, I. J., T. Lillo, and Y. Wu, 2015, "Identification of Nano Crystallographic Parameters of Irradiated SiC to understand Fission product Transport," *ATR NSUF User's week 2015*, Idaho Falls, Idaho, June 24, 2015.
185. van Rooyen, I. J., J. Youngsman, T. M. Lillo, Y. Q. Wu, D. Goran, M. E. Lee, W. E. Goosen, J. H. Neethling, T. L. Trowbridge, and J. W. Madden, 2014, "Methods for Identification of Crystallographic Parameters of Irradiated SiC to Understand Fission Product Transport," *The 3rd Workshop on HTGR SiC Material Properties*, Jeju Island, South Korea, September 30–October 1, 2014.
186. van Rooyen, I. J., T. M. Lillo, Y. Q. Wu, T. Trowbridge, H. Wen, and C. Hill, 2014, "Development and Application of Advanced Characterization Techniques to understand Irradiated TRISO Fuel Behavior," *The 3rd Workshop on HTGR SiC Material Properties*, Jeju Island, South Korea, September 30–October 1, 2014.
187. Warren, G. A, K. K. Anderson, J. A. Kulisek, Y. Danon, A. Wertz, A. Gavron, J. T. Harris, and T. Stewart, 2015, "Lead Slowing Down Spectrometry Analysis of Data from Measurements on Nuclear Fuel," *Nuclear Science and Technology* 179(3): 264–273.



188. Watkins, J. K., G. A. Alanko, S. H. Blatt, C. A. Bradbury, M. J. Kohn, M. Lytle, D. Lacroix, J. Taylor, J. Dudgeon, R. E. Hazard, E. O'Leary-Jepson, and D. P. Butt, 2015, "A Transdisciplinary Approach to Determining the Provenience of a Distorted, Pre-Columbian Skull Recovered in Rural Idaho," *12th Annual Boise State University Undergraduate Research Conference*, Boise, Idaho, April 20, 2015.
189. Webb, J. and I. Charit, 2015, "Neutronic Effects of Rhenium, Gadolinia, and Uranium Dioxide Addition to a Tungsten Based Fast Spectrum Space Reactor," *Annals of Nuclear Energy* 79: 9–17.
190. Wells, P. B., G. R. Odette, T. Yamamoto, Y. Wu, and N. Almirall, 2014, "On Developing a Mechanistic Model and Supporting Database to Predict High Fluence-Low Flux Extended Life RPV Embrittlement," *ANS 2014 Winter Meeting*, Anaheim, California, November 10–15, 2014.
191. Wells, P. B., G. R. Odette, T. Yamamoto, N. Almirall, and Y. Wu, 2014, "The Status of a Low-Flux, High-Fluence Embrittlement Prediction Model for Reactor Pressure Vessel Extended Life," *ATR NSUF Semi-Annual Review*, Washington D.C., December 9–10, 2014.
192. Wells, P. B., N. Cunningham, G. R. Odette, T. Yamamoto, and D. Gragg, 2015, "Characterization of Nano-Precipitates in Irradiated RPV Steels: A Critical Comparison of SANS and APT Techniques," *TMS 2015 Annual Meeting*, Orlando, Florida, March 14–19, 2015.
193. Wells, P. B., N. Almirall, G. R. Odette, T. Yamamoto, D. Gragg, H. Ke, and D. Morgan, 2015, "Thermal Stability of Nanoscale Mn-Ni-Si Precipitates in Irradiated Reactor Pressure Vessel Steels," *TMS 2015 Annual Meeting*, Orlando, Florida, March 14–19, 2015.
194. Wells, P. B., G. R. Odette, T. Yamamoto, and N. Almirall, 2015, "The Status of a Low-Flux, High-Fluence Embrittlement Prediction Model for Reactor Pressure Vessel Extended Life," *ATR NSUF Industry Advisory Committee Meeting*, Charlotte, North Carolina, June 30–July 1, 2015.
195. Wen, H. M., I. J. van Rooyen, J. D. Hunn, T. J. Gerczak, C. A. Baldwin, and F. C. Montgomery, 2015, "Advanced Microscopy Study of Fission Product Distribution in the Failed SiC Layer of a Neutron Irradiated TRISO Coated Particle," *2015 Microscopy and Microanalysis Meeting*, Portland, Oregon, August 2–6, 2015.
196. Wen, H. M., I. J. van Rooyen, C. Hill, T. L. Trowbridge, and B. D. Coryell, 2015, "Fission Products Distribution in TRISO Coated Fuel Particles Neutron Irradiated to  $3.22 \times 10^{25}$  n/m<sup>2</sup> Fast Fluence at 1092°C," *2015 ASME Power and Energy Conference ASME Nuclear Forum*, San Diego, California, June 28–July 2, 2015.
197. Wen, H., I. J. van Rooyen, J. D. Hunn, T. J. Gerczak, C. A. Baldwin, and F. C. Montgomery, 2015, "Advanced Electron Microscopy Study of Fission Product Distribution in the Failed SiC Layer of a Neutron Irradiated TRISO Coated Particle," paper No. 0374, *Microscopy and Microanalysis* 21(3): 747–748, doi:10.1017/S1431927615004535.
198. Wen, H., I. J. van Rooyen, J. D. Hunn, and T. J. Gerczak, 2015, "Advanced Electron Microscopy Study of Pd, Ag, and Cs in Carbon Areas in the Locally Corroded SiC Layer in a Neutron Irradiated TRISO Fuel Particle," to be submitted to *Nuclear Engineering and Design or Journal of Nuclear Materials* in October 2015.
199. Wen, H. and I. J. van Rooyen, 2015, "Fission Products Palladium, Silver, and Cesium Distribution in the SiC Layer with Local Corrosion in a Neutron Irradiated TRISO Fuel Particle," paper to be submitted to *Nuclear Engineering and Design or Journal of Nuclear Materials* in November 2015.
200. Wharry, J. P., M. J. Swenson, and C. K. Dolph, 2014, "On the Relationship Between Sink Strength and Irradiation Hardening in an ODS Steel," *XXIII International Materials Research Congress (IMRC 2014)*, Cancún, Mexico, August 2014.
201. Wharry, J. P., M. J. Swenson, and C. K. Dolph, 2014, "Microstructure-Mechanical Property Relationship in Self-Ion Irradiated ODS and F/M Alloys," *European Materials Research Society*, Warsaw, Poland, September 2014.
202. Wharry, J. P., 2014, "Hardening Mechanisms in Neutron and Ion-Irradiated Fe-9Cr ODS Alloy," *Mechanical and Aerospace Engineering Department Seminar*, University of California – Irvine, Irvine California, October 2014.
203. Wharry, J. P., M. J. Swenson, and C. K. Dolph, 2015, "Comparison of Proton and Neutron Irradiation Effects in ODS and F/M Alloys," *57th Idaho Academy of Science and Engineering (IASE) Annual Meeting and Symposium*, Boise, Idaho, March 2015.
204. Wharry, J. P., A. M. Monterrosa, and G. S. Was, 2015, "Radiation-Induced Segregation at High Doses in Self-Ion Irradiated F/M Alloys," *The Minerals, Metals and Materials Society Annual Meeting*, Orlando Florida, March 2015.
205. Wharry, J. P., M. J. Swenson, and C. K. Dolph, 2015, "Modeling Irradiation Hardening in Oxide Dispersion Strengthened Steels," *Center for Advanced Energy Studies Materials, Modeling, Simulation, and Visualization Workshop*, McCall, Idaho, May 2015.
206. Wharry, J. P., 2015, "Role of Solid Solution Strengthening in Irradiated F/M and ODS Alloys," *Nuclear Science User Facilities Annual Users Meeting*, Idaho Falls, Idaho, June 2015.
207. Wharry, J. P., 2015, "Comparison of Proton and Neutron Irradiation Effects in Fe-9Cr ODS Alloy," *Annual Nuclear Science User Facilities Industry Advisory Committee Meeting*, Charlotte, North Carolina, July 2015.
208. Wharry, J. P., 2015, "Irradiation Hardening Characteristics of Oxide Dispersion Strengthened Alloys," *Mechanical, Industrial, and Manufacturing Engineering Department Seminar*, Oregon State University, Corvallis, Oregon, October 2015.
209. Wharry, J. P., M. J. Swenson, and C. K. Dolph, 2016, "Influence of Irradiation Particle and Dose Rate on Strengthening Mechanisms of Model ODS Alloy," *International Conference on Plasticity*, Kailua-Kona Hawaii, scheduled for January 2016.
210. Williamson, I., E. B. Nelson, and L. Li, 2015, "Carbon Dioxide Sorption in a Nanoporous Octahedral Molecular Sieve," *Journal of Physics D: Applied Physics* 48: 335304.
211. Wolf, K., G. Belev, M. Ailavajhala, D. A. Tenne, H. Barnaby, M. N. Kozicki, and M. Mitkova, 2015, "Wide Range Intensity X-ray Radiation Induced Effects in Conductive Bridge Resistance Change NonVolatile Memory Devices and the Materials Building These Devices," *RAD 3 2015*, Montenegro, Budva, June 8–12, 2015.
212. Wolf, K., M. S. Ailavajhala, D. A. Tenne, H. Barnaby, M. N. Kozicki, and M. Mitkova, 2015, "EBeam Induced Effects in Ge-Se-Based Redox Conductive Bridge Memory Devices and Thin Films," *TMS Annual Meeting and Exhibition 2015*, Orlando, Florida, March 15–19, 2015.
213. Wong-Ng, W., J. A. Kaduk, D. L. Siderius, A. L. Allen, L. Espinal, B. M. Boyerinas, I. Levin, M. R. Suichomel, J. Ilavsky, L. Li, I. Williamson, E. Cockayne, and H. Wu, 2015, "Reference Diffraction Patterns, Microstructure, and Pore Size Distribution for the Copper (II) benzene-1,3,5-tricarboxylate Metal Organic Framework (Cu-BTC) Compounds," *Powder Diffraction* 30: 213.
214. Wu, Y. Q., M. Kaur, H. Zhang, Y. Qiang, L. R. Martin, and T. Todd, 2015, "Characterization of Magnetic Cr-doped Fe-Fe oxide core-shell nanoparticles for used nuclear fuel separation," *TMS2015*, Orlando, Florida, March 15–19, 2015.
215. Wu, Y. Q., 2015, "Characterization of Magnetic nanoparticles for used nuclear fuel separation," *Advances in Structural and Chemical Imaging (ASCI) 2015*, Pullman, Washington, May 20–22, 2015.

216. Wu, Y. Q., K. N. Allahar, J. Burns, B. Jaques, I. Charit, D. P. Butt, and J. I. Cole, 2014, "Fe-Cr-Mo Based ODS Alloys Via Spark Plasma Sintering: A Combinational Characterization Study by TEM and APT," *Crystal Research Technology* 49(9): 645652.
217. Wu, Y. Q., 2015, "Application of advanced characterization techniques in ODS alloys," *MS&T 2015*, Columbus, Ohio, October 4–8, 2015.
218. Wu, Y. Q., 2015, "Combination of TEM and APT Studies on Various Materials at MaCS, CAES," Department of Physics, University of Idaho, Moscow, Idaho, August 31, 2015.
219. Wu, Y. Q., I. J. van Rooyen, H. M. Wen, J. Burns, and J. W. Madden, 2016, "Microstructure Characterization of TRISO fuels by Atom Probe Tomography," *TMS2016*, Nashville, Tennessee, February 14–18, 2016.
220. Xie, Y., Y. Wu, J. Burns, and J. Zhang, 2015, "Characterization of Stress Corrosion Cracking of Weld Nickel Alloys 52, 52M and 152 at High Temperature," submitted to *Materials Characteristics*.
221. Xiong, H., 2015, "Nanostructured Electrode Materials for Li-ion and Na-ion Batteries," University of Idaho, Department of Physics, Moscow, Idaho, January 2015.
222. Xiong, H., 2015, "Nanostructured Electrode Materials for Li-ion and Na-ion Batteries," Boise State University, Department of Chemistry, Boise, Idaho, February 2015.
223. Xiong, H., 2015, "Nanostructured Electrode Materials for Na-ion Batteries," 2015 Idaho Academy of Science Annual Conference, Boise, Idaho, March 2015.
224. Xiong, H., 2015, "Nanostructured Electrode Materials for Li-ion and Na-ion Batteries," Energy Processes and Materials Division, Pacific Northwest National Laboratory, September 2015.
225. Xiong, H., 2015, "Nanostructured Electrode Materials for Li-ion Batteries," NASA Glenn Research Center, October 15, 2015.
226. Xiong, H., 2015, "Nanostructured Electrode Materials for Na-ion Batteries," University of New Hampshire, Chemical Engineering, New Hampshire, New Hampshire, October 2015.
227. Xiong, H., 2015, "Nanostructured Metal Oxide Anode for Li-ion and Na-ion Batteries," Ohio State University, Department of Chemistry, Columbus, Ohio, October 2015.
228. Xiong, H., 2015, "Understanding Electrode-electrolyte Solution Interactions between TiO<sub>2</sub> Nanotube Electrode and Nonaqueous Electrolytes for Sodium-ion Batteries," *2nd International Sodium Battery Conference*, Chandler, Arizona, October 2015.
229. Xiong, H., 2015, "Trends in Na-Ion Solvation with Alkyl-Carbonate Electrolytes for Sodium-Ion Batteries: Insights from First-Principles Calculations," *Journal of Physical Chemistry C*, DOI: 10.1021/acs.jpcc.5b04706.
230. Yablinsky, C. A., Y. Wu, A. J. Clarke, and R. E. Hackenberg, 2015, "Atom Probe Characterization of Phase Separation during Age Hardening of a U-6wt.%Nb Alloy," *MS&T 2015*, Columbus, Ohio, October 4–8, 2015.
231. Yoo, C., K. Kim, C. Park, and D. Bae, 2015, "Quantification of Tree Root Depth for Basin-Scale Sediment Yield Simulation," *Journal of Korean Society of Hazard Mitigation* 15(3): 301–311.
232. Zhang, H., L. R. Martin, Y. Wu, and Y. Qiang, 2015, "Magnetic Nanosorbents for Recycling Spent Nuclear Fuel," *TMS2015*, Orlando, Florida, March 15–19, 2015.
233. Zhang, Y., M. Cleary, X. Wang, N. Kempf, L. Schoensee, J. Yang, G. Joshi, and L. Meda, 2015, "High-Temperature and High-Power-Density Nanostructured Thermoelectric Generator for Automotive Waste Heat Recovery," *Energy Conversion and Management* 105: 946.
234. Zhang, Y., X. Wang, M. Cleary, L. Schoensee, and N. Kempf, 2015, "High-Performance Nanostructured Thermoelectric Generators for Micro Combined Heat and Power Systems," *Applied Thermal Engineering*, under revision.
235. Zhao, H., S. T. Oyama, H.-J. Freund, R. Włodarczyk, and M. Sierka, 2015, "Nature of Active Sites in Ni<sub>3</sub>P Hydrotreating Catalysts as Probed by Iron Substitution," *Applied Catalysis B: Environmental* 164(0): 204–216.
- 236/237. In addition, there were two additional confidential/proprietary publications that cannot be cited.

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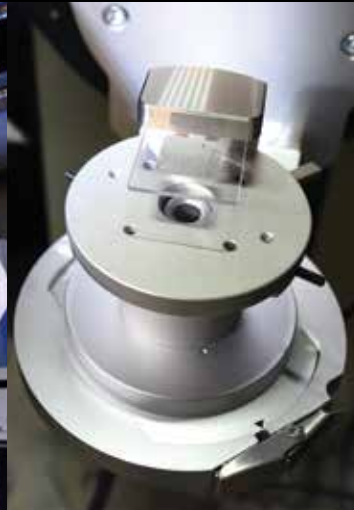
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