Nuclear Notes

Nuclear Engineering
400 Central Drive
West Lafayette, IN
47907

A Message from the Interim Head

December 2007

There has been a lot of activity going on in Nuclear Engineering this Fall. In addition to three new faculty joining us, we have two new Business Office clerks, Sophia McKinsey and Roma Jones as well as Dr. Valeryi Sizyuk an Dr. Tatyana Sizyuk (more on page 3). We are also in the process of obtaining the middle section of our building as AERO is moving to Armstrong (more on page 9).

Nuclear Engineering has received an endowment fund of $500,000 for the support of the Paul C. Zmola Scholar of Nuclear Engineering. This will be used to recognized an outstanding newly-hired assistant or associate professor or an outstanding current assistant or associate professor in the School of Nuclear Engineering.

Nuclear Engineering has hit a record high number; we have over 60 current and incoming Freshman enrolled for NUCL 205

Have a safe holiday break!

Congratulations to all of our graduates!

PhD:

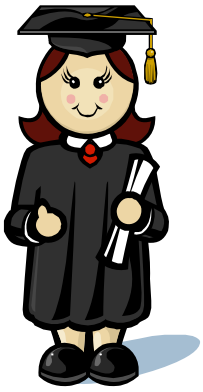
Shaun Clarke

Volkan Seker

Yong Jae Song

MS:

Nick Brown



BSNE:

Brian Ade

Nicholas Cole

Jason Downey

Carolyne Joseph

Patrick Kohtz

Arthur Pan

Marvin Weniger

Timothy Siefer

Liyuan Zhang

Funding Opportunities

J. P. Allain—$30,000— Materials Modification Inc— “Nano-Tungsten for ITER Divertor Plate”

T. Downar—$10,000—Oak Ridge National Laboratory—”Modeling and Simulation for Photonuclear Interrogation of Fissile Material”

T. Downar—$99,630—Nuclear Regulatory Commission—”Parcs Development Maintenance and Assessment for Stability Analysis”

T. Downar—$380,000—Nuclear Regulatory Commission—”Parcs Development Maintenance and Assessment”

A. Hassanein—$500,000—Argonne National Laboratory—”Advanced Modeling and Computational of Major Plasma Instabilities in Fusion Devices”

T. Hibiki, M. Ishii—$70,000—Nuclear Regulatory Commission—”Thermal-Hydraulic Experimental and Model Development Support for the Trace Code—NRC Task 1

M. Ishii—$65,000—Nuclear Regulatory Commission—”Thermal-Hydraulic Experimental and Model Development Support for the Trace Code—NRC Task 4

M. Ishii, T Hibiki—$70,000– Nuclear Regulatory Commission—”Thermal-Hydraulic Experimental and Model Development Support for the Trace Code—NRC Task 2—Revised”

T. Jevremovic, L. Tsoukalas, C. Choi and R. Gao—$406,671—National Science Foundation—”ARI-MA: Intelligent Model-Assisted Sensing Systems (IMass) for Fast and Accurate Nuclear Material Interrogation”

New Courses

NUCL 497A:

Professor J.P. Allain

Radiation Modification of Materials. The course is an introduction to the interaction and modification of materials with radiation. In particular the course will introduce the student to the elements and fundamentals of radiation interaction with materials. Applications will include nuclear fission and fusion materials. Topics Include: Introduction to nuclear reactor materials, thermal properties of solids, cohesive energy of solids, interatomic potentials, dynamics of binary elastic collisions, cross sections, defects in crystalline solids, dislocations, grain boundaries, radiation damage processes, displacements per atom, fundamentals aspects in thermodynamics and kinetic effects in radiation damage

NUCL 520:

Professor A. Hassanein

Course Description: An introduction to radiation damage effects in nuclear materials, nature of point defects, their production, their kinetics, how these defects migrate and cluster, their effects on materials both physical and mechanical properties.

New Faces in Nuclear Engineering

Sophia McKinsey has joined Nuclear Engineering as our new Business Office Clerk. Sophia has worked at Purdue University for 10 years, the last 3 years she was in Electrical and Computer Engineering.

Roma Jones has joined Nuclear Engineering as a Business Office Clerk. Roma was located in POTR in the LORRE office. Roma will still be maintaining her duties with the LORRE office.

Dr. Valeryi Sizyuk—Visiting Professor and Dr. Tatyana Sizyuk—Computer Analyst have both joined Nuclear Engineering and will be working with Dr. Hassanein; their offices will be located in Potter.

Sophia Mckinsey

Roma Jones

Valeryi Sizyuk

Tatyana Sizyuk

ANS News

ANS Officers:

President—Sheila Bolbolan

Vice President—Felisa Limon

Treasurer—Charlton Campbell

Secretary—Carrie Bloink

Committee Chairs:

Special Events Chair—Daniel Jabaay

Outreach Chair— Doug French

Corporate Chair—Kurt Walter

ANS News:

We would also like to take this opportunity to thank all those that helped with nuke week. It was great to see everyone involved!

Papers

J.P. Allain, et al., "IMPACT: a facility studying the interaction of low-energy intense charged particle beams with dynamic heterogeneous surfaces" Review of Scientific Instruments, 78 (2007) 113105

J.P. Allain, M.D. Coventry, D.N. Ruzic. "Non-linear sputtering of D-treated liquid lithium under light-particle, low-energy bombardment" Phys. Rev. B, 76 (2007) 205434

J.P. Allain, et al., "IMPACT: a facility studying the interaction of low-energy intense charged particle beams with dynamic heterogeneous surfaces" Review of Scientific Instruments, 78 (2007) 113105

Li Cheng-Yue, **J.P. Allain**, Deng Bai-Quan, "Effects of a liquid lithium curtain as the first wall in a fusion reactor plasma" Chinese Physics, 16 (11) (2007) 3312

J.P. Allain, et al. "In-situ elemental and chemical state characterization of lithiated surfaces under energetic particle bombardment" Bull. American Phys. Soc. Vol. 52, No. 16 (2007) 267

J.P. Allain, et al. "XPS studies of NSTX tiles and in-situ analysis of Li-exposed graphite simulating plasma-Li surface interactions" Bull. American Phys. Soc. Vol. 52, No. 16 (2007) 297

Shripad T. Revankar and Travis Croy, Visualization study of the shrinkage void distribution in thermal energy storage capsules of different geometry, Experimental Thermal and Fluid Science, 31,181–189 (2007)

Seungmin Oh, Haijing Gao, **Shripad T. Revankar**, Investigation of a passive condenser system of advanced boiling water reactor, J. Nuclear Technology, 158, 208-218 (2007)

Derek W. Hengeveld and **Shripad T. Revankar*,** Economic Analysis of a Combined Heat and Power Molten Carbonate Fuel Cell System, Journal of Power Sources, 165, 300-306 (2007)

Shripad T. Revankar*, Hayden Olenik, Daeseong, Jo, Brian Motil, Local instrumentation for the investigation of multiphase parameters in a packed bed, Proceedings of the Institution of Mechanical Engineers, Part E, Journal of Process Mechanical Engineering, 221, 187-199 (2007)

Papers

C. Haefner, **I. Jovanovic**, B. Wattellier, and C. P. J. Barty, "Demonstration of pulse switching with >10^11 prepulse contrast by optical parametric amplification", in Ultrafast Optics V, Springer Verlag (2007).

I. Jovanovic, N. Forget, C. G. Brown, C. A. Ebbers, C. Le Blanc, and C. P. J. Barty, "Double-passed, high-energy, quasi-phase-matched optical parametric chirped-pulse amplifier," in Ultrafast Optics V, Springer Verlag (2007).

A. Link, K. Akli, D. Offermann, V. Ovchinnikov, L. Van Woerkom, R.R. Freeman, H. Chen, **I. Jovanovic**, A. Kemp, A. Mackinnon, A. Macphee, Y. Ping, R. Shepherd, S.C. Wilks, Cliff Chen, L. Elberson, J. King, T. Ma, F. Beg, R. AkliClarke, "Specular Reflection of Intense Laser Light Interacting with Solid Targets," ," APS 49th Annual Meeting of the Division of Plasma Physics, Orlando, FL, November 12-16, 2007.

J.D. Moody, P. Datte, E. Ng, K. Maitland, W. Hsing, B.J. MacGowan, D.H. Froula, P. Neumayer, L. Sutter, N. Meezan, S.H. Glenzer, R.K. Kirkwood, L. Divol, S. Andrews, J. Jackson, A. Mackinnon, **I. Jovanovic**, R. Beeler, L. Bertolini, M. Landon, S. Alvarez, T. Lee, P. Watts, "Design of the optical backscatter diagnostic for laser plasma interaction measurements on NIF," APS 49th Annual Meeting of the Division of Plasma Physics, Orlando, FL, November 12-16, 2007

A.G. MacPhee, C.D. Chen, D. Hey**, I. Jovanovic,** M.H. Key, T.W. Phillips, A.J. Mackinnon, R. Clarke, K. Akli, D. Offermann, A. Link, V. Ovchinnikov, L. Van Woerkom, R. Freeman, J. Pasley, M. Wei, T.Y. Ma, J. King, F.N. Beg, and R.B. Stephens, "Short pulse laser coupling efficiency to hot electrons for fast-ignition studies," APS 49th Annual Meeting of the Division of Plasma Physics, Orlando, FL, November 12-16, 2007

M. Shverdin, S. Anderson, C. Brown, S. Betts, D. Gibson, J. Hernandez, M. Johnson, **I. Jovanovic**, D. McNabb, M. Messerly, J. Pruet, A. Tremaine, F. Hartemann, C. Siders, and C.P.J. Barty, "High Power Picosecond Laser Pulse Recirculation for Compton Scattering," APS 49th Annual Meeting of the Division of Plasma Physics, Orlando, FL, November 12-16, 2007

Papers

C. Siders, S. Anderson, S. Betts, D. Gibson, J. Hernandez, M. Johnson, **I. Jovanovic**, D. McNabb, M. Messerly, J. Pruet, M. Shverdin, A. Tremaine, F. Hartemann, and C.P.J. Barty, "Fiber-Based, Spatially and Temporally Shaped Picosecond UV Laser for Advanced RF Gun Applications," APS 49th Annual Meeting of the Division of Plasma Physics, Orlando, Florida, November 12-16, 2007

C. D. Winant, A. Bernstein, C. Hagmann, K. Kazkaz, P. Kerr, **I. Jovanovic**, and W. Stoeffl, W, "Dual-phase argon ionization detector for measurement of coherent elastic neutrino scattering and medium-energy nuclear recoils," IEEE Nuclear Science Symposium and Medical Imaging Conference , Honolulu, HI, October 28-November 3, 2007.

Lithiated surfaces work by Allain highlighted at the American Physical Society Meeting of the Division of Plasma Physics in Orlando, FL

Prof. J.P. Allain's work on lithiated metallic surfaces was highlighted in an invited talk given at the APS-DPP Meeting in Orlando, FL in mid-November. Prof. Allain presented recent work on how lithium surface properties can influence operational regimes (i.e. plasma edge particle control) in magnetic fusion reactors. This work highlighted an on-going collaboration between Prof. Allain's group and the Princeton Plasma Physics Laboratory. In particular collaborative work with the National Spherical Tokamak Experiment (NSTX) which is slated to have an advanced liquid Li divertor installed in FY 2009 and will provide novel new confinement regimes for plasma operation.

The work by Prof. Allain's group examines the interaction of energetic D with lithiated ATJ graphite surfaces in support of lithium wall coatings and LLD (liquid lithium divertor) work in NSTX. This effort is accomplished using state-of-the art particle beam facilities. Lithium has been considered as a potentially viable plasma-facing surface enhancing the operation of devices such as TFTR and recently NSTX. Lithium wall conditioning provides an enabling technology to control plasma recycling of hydrogen isotopes enhancing plasma performance.

The lithium surface, in the liquid and solid state, has been studied extensively both in its erosion and coating properties by Prof. Allain and colleagues.

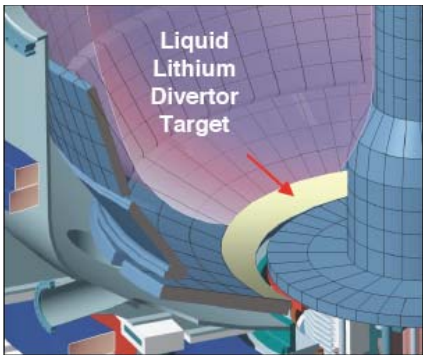


Figure 1. The liquid lithium divertor (LLD) to be installed in NSTX during FY 2009 by Sandia National Laboratory.

However, there is limited or no data on the uptake properties of hydrogen isotopes in lithiated graphite

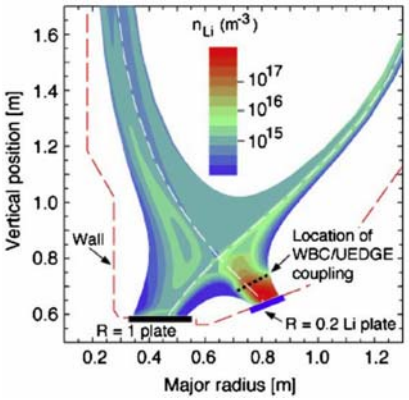


Figure 2. Computed lithium ion density (all charge states) using coupled surface and erosion re-deposition simulation codes. [J.N. Brooks, J.P. Allain, T. Rognlien, R. Maingi, J. Nucl. Mater. 337-339 (2005) 1053.

structures and lithium film structures deposited on alternate substrates (e.g. Mo, SS, W). In addition, although data exists on D interaction with liquid Li, little data has systematically studied surface properties of liquid Li under simulated conditions found in NSTX. This effort will be started in Spring 2008 using facilities at the Birck Nanotechnology Center and the IMPACT facility in collaboration with Prof. Hassanein's lab in Potter.

News and Awards

Purdue University School of Nuclear Engineering featured on Nightly Business Report.

Event Details	
Event Date:	November 1, 2007

The PBS program *Nightly Business Report* has been airing a feature series this week 10-29-07 to 11-1-07 on nuclear power. Purdue was listed in the 4th segment about the aging current workforce in the field and what was/should be done about the likely shortage of trained workers as the number of nuclear powered plant looks toward a likely expansion. They featured Purdue's NE department as the example of what is being done at universities. There was a rather substantial portion of the feature devoted to Purdue; included were interviews and scenes of the school's students recruiting others into the program. Overall, it provided quite favorable national exposure.

You can go to https://engineering.purdue.edu/NE/Events/ to view the program.

Bryan Sims received the Homeland Security-STEM Career Development Scholarship starting January 1, 2008—December 2010.

Nuclear Engineering Committees

Graduate Committees
Ishii Co-Chair
Hassanein Co-Chair
Downar
Fentiman
Revankar
Taleyarkhan
Tsoukalas
Timmerman

Undergraduate Committee
Tsoukalas Co-Chair
Jevremovic Co-Chair
Allain
Choi
Revankar
Timmerman

Computer Committee
Bertodano Co-Chair
Jovanovic Co-Chair
Choi
Gao
Hibiki
Reece

Curriculum Committee/ABET
Fentiman
Bertodano
Downar
Jovanovic
Revankar
Timmerman

Safety Committee
Hibiki Co-Chair
Jenkins Co-Chair
Gao
Taleyarkhan

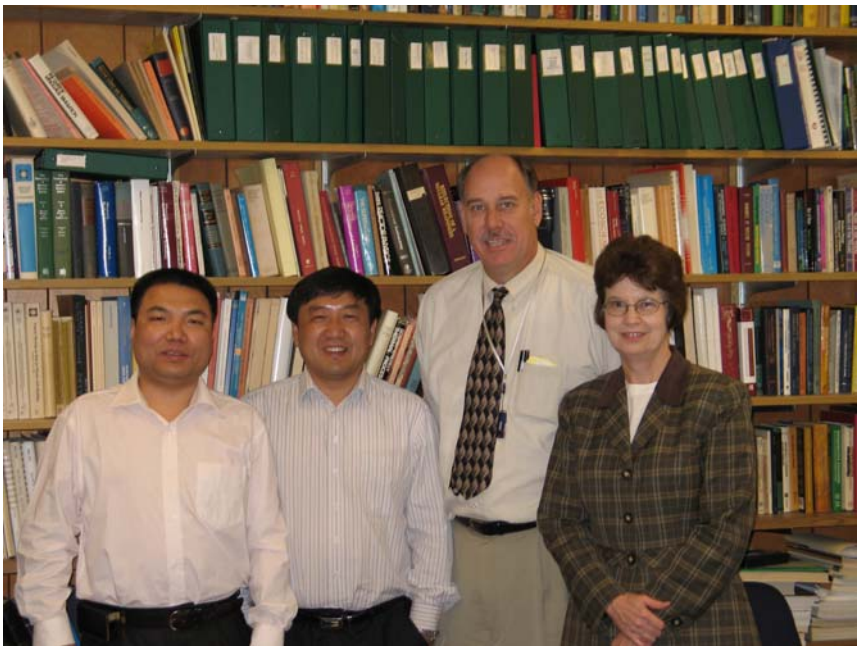
Faculty Search
Hassanein
Ishii

CORO (Committee on Reactor Operations)

Schweitzer	Chair
Jenkins	NUCL
Jevremovic	NUCL
Koltick	PHYS
Merritt	NUCL
Revankar	NUCL
Rosenbarer	Safety & Security
Taleyarkhan	NUCL

FYI

We had delegates from Tsinghua University visiting Purdue University in October. They meet with faculty and we had a colloquium with Professor Yuan-Jing Li and Professor Hanliang Bo.



Remodeling Updates

We are in the process of remodeling the center area of our building. As AERO is moving out we are sending in work orders to paint, clean and get these areas ready for occupancy.

NUCL Room 115 will be the new student computer room/lounge
NUCL Room 127 will be Student Services
NUCL Room 139 Business Office Manager
NUCL Room 132B Temporary Business Office
NUCL Room 102 will be used for current and incoming Graduate Students
NUCL Room 115A—Dr. Allain
NUCL Room 133—Dr. Allain
NUCL Room 137—unassigned
NUCL Room 111—Dr. Allain
NUCL Room 107—unassigned
POTR Room 374A—Dr. V. Sizyuk
POTR Room 376A—Dr. T. Sizyuk
POTR Room 376C—Dr. Hassanein
POTR Room 370—Dr. Hassanein
POTR Room 351—Dr. Jovanovic

We have moved Erica Timmerman (Student Services) to her new office in room 127.

Calendar

December

24th, 25th, 31st—Holiday

January

1st—Holiday
9th—Faculty Meeting - 3:30 p.m. Conference Room
9th—CO OP Call out
14th—Dean Open Forum—9:30 a.m. STEW 206
21st—Martin Luther King Jr. Day

February

6th—Faculty Meeting - 3:30 p.m. Conference Room
29th—Dean Open Forum—9:30 a.m. STEW 206

March

1st—Purdue Next Program (ARMS Atrium)
5th—Faculty Meeting - 3:30 p.m. Conference Room
10th— 15th Spring Break

April

5th—Faculty Meeting - 3:30 p.m. Conference Room
14th—Dean Open Forum—9:30 a.m. East Faculty Lounge, PMU

May

6th—Dean Open Forum—2:00 p.m. STEW 206
9th—Graduation Reception—1:30 p.m. Nuclear Engineering
9th—Spring Commencement—8:00 p.m.

Please submit any corrections or revisions to Kellie Reece at kreece@purdue.edu
If you have any information you would like in the next issue please submit to Kellie Reece at kreece@purdue.edu