# ADITYA P. SHIVPRASAD

#### CURRICULUM VITÆ

# GRADUATE RESEARCH ASSISTANT Department of Mechanical and Nuclear Engineering Pennsylvania State University 128 Hammond Building University Park, PA USA 16802 Email: aps202@psu.edu

#### EDUCATION

Pennsylvania State University, College of Engineering, University Park, PA	Aug. 2017
Ph.D. in Nuclear Engineering, GPA: 4.0/4.0	(expected)
: The role of nickel in hydrogen pick-up during in-reactor corrosion of zirconium alloys	
Advisor: Professor Arthur T. Motta	
University of California, Berkeley, College of Engineering, Berkeley, CA	May 2011
B.S. in Nuclear Engineering	-
Senior Project: Designed and assessed the feasibility of a sodium-cooled fast reactor using an Accelerator Driven Energy Multiplier (ADEM). Fresh fuel for the concept was discharged from a Breed-and-Burn critical core at an average burn- up of 20% and re-clad over the existing cladding. Reactor core calculations were performed using MCNP5 coupled with ORIGEN using the MOCUP code to create new input files to simulate core shuffling.	
University of California, Berkeley, College of Chemistry, Berkeley, CA	May 2011
B.S. in Chemical Engineering	5
Senior Project: Designed and simulated a method of producing methanol using Decker coal using separations processes to remove acids and solids, a water-gas shift reactor to convert syngas to carbon dioxide and hydrogen, which were then used to synthesize methanol. An additional Claus Process was introduced to remove sulfur from the acid gas so as to meet EPA regulations. Design calculations were performed using the ASPEN Plus program.	

#### **RESEARCH INTERESTS**

Environmental degradation of materials in nuclear reactors with an emphasis on corrosion and hydrogen pick-up of zirconium alloys. Specific research efforts involve performing microchemical and microstructural examinations using synchrotron radiation X-ray absorption near-edge spectroscopy and X-ray diffraction.

 TEACHING EXPERIENCE
 Fall 2016

 Pennsylvania State University, College of Engineering, University Park, PA
 Fall 2016

 Course Instructor/Distinguished Teaching Fellow: Nuclear Engineering 409 –
 Nuclear Materials

 Instructed and developed course syllabus, lecture notes, homework assignments, and exam questions for course on nuclear materials. The main objective of the course was to
 Fall 2016

teach the fundamentals of materials degradation processes in a nuclear reactor, particularly light water reactors. The first half of the course focused on materials science outside of the reactor and included crystallography, thermodynamics, and mechanical properties. The second half of the course introduced the concept of radiation damage and degradation mechanisms were studied in terms of rate theory. Advanced concepts included corrosion and growth of zirconium alloys and fission product behavior in oxide fuels.

Pennsylvania State University, College of Engineering, University Park, PA	Spring 2012
Graduate Teaching Assistant: Nuclear Engineering 409 – Nuclear Materials	
Teaching assistant for nuclear materials course under the supervision of Prof. Arthur T.	
Motta. Responsibilities included holding office hours and grading homework.	

**Pennsylvania State University, College of Engineering,** University Park, PA **Graduate Teaching Assistant:** Nuclear Engineering 405 – Nuclear and Radiochemistry

Teaching assistant for nuclear and radiochemistry course under the supervision of Prof. Gary Catchen. Responsibilities consisted of leading exam review sessions, holding office hours, and grading homework.

#### **RESEARCH EXPERIENCE**

# **Pennsylvania State University, College of Engineering,** University Park, PA Graduate Research Assistant/Ph.D. Candidate

Advisor: Prof. Arthur T. Motta

- Examined hydrogen pick-up of Zircaloy-2 water rods corroded in-reactor to high burn-up and correlated results with oxide microstructure and oxidation state of alloying elements upon incorporation into the oxide layer. Characterization techniques included microbeam synchrotron radiation X-ray diffraction and X-ray absorption near edge spectroscopy (XANES), as well as optical microscopy, focused ion beam sample preparation, and scanning electron microscopic techniques.
- Characterized alloying element chemistry in autoclave-corroded Zircaloy-2 and correlated results with those obtained from reactor-corroded materials. Analysis was performed using the XANES technique.
- Performed *ab initio* simulations of X-ray absorption spectra of nickel and iron compounds to compare with experimental observations. Calculations were performed using the FEFF9 code.
- Designed novel examination methods to characterize zirconium alloy oxide microstructure and chemical state using synchrotron radiation methods.
- Supervised an undergraduate research fellow funded through the Toshiba-Westinghouse Fellowship Program. The student was directed to study the corrosion properties of Zircaloy-2 using surface examination methods such as optical microscopy, scanning electron microscopy, and atom force microscopy.

## University of California, Berkeley, College of Chemistry, Berkeley, CA Student Researcher

Advisors: Prof. Peter Hosemann and Dr. Alan Bolind

• Worked closely with post-doctoral researcher, Dr. Alan Bolind, to design and develop a system with which the oxidation of liquid heavy metals was studied. Oxidation potential of liquid tin as a function of temperature and cover gas

Fall 2011

2012-present

2010-2011

composition was measured to determine the oxygen saturation of tin manufactured for solar applications.

• Assisted in design and assembly of experimental setup for irradiation-corrosion experiment (ICE2) performed by graduate student, Staffan Qvist. Experimental goals were to corrode HT9 steel in lead-bismuth eutectic while exposed to a proton beam to damage the steel. Design considerations for corrosion setup were based on results of tin oxygen control.

# University of California, Berkeley, College of Chemistry, Berkeley, CA Student Researcher

2010

Advisor: Prof. Eric B. Norman

• Worked closely under the supervision of Prof. Eric B. Norman to measure the half-lives of various nuclides and the energies associated with their decay modes. One particular study included the calculation of gamma rays produced during the decay of chlorine-38. Calculated results were compared with those of previous studies.

## REFEREED PAPERS

- 1. <u>Shivprasad, A. P.</u>, Motta, A. T., Kucuk, A., Yagnik, S. & Cai, Z. in *18th International Symposium on Zirconium in the Nuclear Industry*. (eds R. J. Comstock & A. T. Motta) (ASTM International, West Conshohocken, PA).
- Bolind, A. M., <u>Shivprasad, A. P.</u>, Frazer, D. & Hosemann, P. Essential aspects of controlling the oxygen content of molten tin in engineering applications. *Materials & Design* 52, 168-178, doi:DOI 10.1016/j.matdes.2013.04.096 (2013).
- 3. Krane, K. S., Keck, M. L., Norman, E. B. & <u>Shivprasad, A. P.</u> Gamma-ray energies in the decay of 38Cl. *Appl Radiat Isot* **70**, 740-742, doi:10.1016/j.apradiso.2011.12.033 (2012).

## TECHNICAL REPORTS

- 1. <u>Shivprasad, A.P.</u>; Motta, A.T. Synchrotron radiation examinations of high- and lowhydrogen pick-up irradiated Zircaloy-2 water rods. Final report to EPRI – Nuclear Fuel Industry Research. **March, 2016**.
- 2. <u>Shivprasad, A.P.</u>; Motta, A.T. Synchrotron radiation examinations of irradiated and unirradiated Zircaloy-2 materials. Yearly report to EPRI Nuclear Fuel Industry Research. **September, 2014**.

## CONTRIBUTED CONFERENCE PRESENTATIONS

- <u>Shivprasad, A. P.</u>, Motta, A. T., Kucuk, A., Yagnik, S. & Cai, Z. Microbeam X-ray Absorption Near-edge Spectroscopy of Alloying Elements in the Oxide Layers of Irradiated Zircaloy-2. 18<sup>th</sup> International Symposium on Zirconium in the Nuclear Industry. Hilton Head, SC. May 17, 2016.
- <u>Shivprasad, A.P.</u>; Motta, A.T. Microbeam X-ray absorption near-edge spectroscopic studies of high-burnup Zircaloy-2 oxide layers. EPRI – Nuclear Fuel Industry Research group. Halden, Norway. October 9, 2015.

- <u>Shivprasad, A.P.</u>; Motta, A.T. Microbeam synchrotron radiation studies of irradiated Zircaloy-2 oxide layers. EPRI – HYDRanZeA Workshop. Charlotte, NC. February 24, 2015.
- <u>Shivprasad, A.P.</u>; Motta, A.T. X-ray diffraction studies of irradiated Zircaloy-2 oxide layers. Presentation to EPRI – Nuclear Fuel Industry Research group. Richland, WA. October 9, 2014.
- 5. <u>Shivprasad, A.P.</u>; Motta, A.T. X-ray absorption near-edge spectroscopy of Ni in irradiated Zircaloy-2 oxide layers. Presentation to EPRI Nuclear Fuel Industry Research group. Zurich, Switzerland. **May 13, 2014**.
- 6. <u>Shivprasad, A.P.</u>; Motta, A.T. Analysis of synchrotron radiation examination of irradiated Zircaloy-2 oxide layer using XANES and micro diffraction. Presentation to EPRI HYDRanZeA expert team. **February 3, 2014**.
- <u>Shivprasad, A.P.</u>; Motta, A.T. Characterization of irradiated Zr-based alloys and alloy oxides using synchrotron radiation. EPRI – HYDRanZeA Workshop. Wilmington, NC. April 15, 2013.

AWARDS AND HONORS <b>NRC Fellowship,</b> The U.S. Nuclear Regulatory Commission Fellowship awarded to graduate students funded by the U.S. NRC.	Spring 2017
Distinguished Teaching Fellow, Pennsylvania State University, College of Engineering, University Park, PA Fellowship awarded to provide qualified students with experiences that will enhance the career success of fellows, particularly those who plan to pursue faculty positions. Fellowship was awarded to teach the course Nuclear Engineering 409 – Nuclear Materials. Award included access to new faculty workshops and exclusive professional development opportunities.	Fall 2016
<b>NRC Fellowship,</b> The U.S. Nuclear Regulatory Commission Fellowship awarded to graduate students funded by the U.S. NRC.	Spring 2016

#### Skills

- Experimental: synchrotron radiation techniques including fluorescence mapping, X-ray diffraction; X-ray absorption near-edge structure (XANES); and extended X-ray absorption fine structure (EXAFS), scanning electron microscopy, focused ion beam serial sectioning, transmission electron microscopy, impedance spectroscopy, atomic force microscopy, metallography.
- Engineering software: MATLAB, Solidworks, Demeter software suite, FEFF9, Fit2D, PeakFit, Medusa, CrystalMaker, VESTA, Mathematica, Maple, MathCAD, GSAS, Jade
- Miscellaneous: Microsoft Office, Adobe Creative Suite, LaTeX

# PROFESSIONAL MEMBERSHIPS

- ASTM International
- American Nuclear Society
- American Chemical Society
- Institute of Nuclear Materials Management