

Department of Chemical & Biomolecular Engineering

SCHOENBORN

GRADUATE RESEARCH SYMPOSIUM



Judged competitions of formal oral and
poster presentations of graduate research

Monday, January 25, 2016

8:00 AM - 6:00 PM

McKimmon Center

<http://www.che.ncsu.edu/schoenborn>

Schoenborn 2016 Graduate Research Symposium

8:00–8:20 am Continental Breakfast / Welcome

8:20–10:00 am Oral presentations Session I: Kinetics

- 8:20 am **Nathan Galinsky** *Effect of Support on Metal Oxide Design for Chemical Looping Conversion of Methane*
- 8:40 am **Craig Needham** *Building Reaction Mechanisms Using Computational Chemistry*
- 9:00 am **Arya Shafiefarhood** *Core-Shell Redox Catalysts for Partial Oxidation of Methane*
- 9:20 am **Martin Dufficy** *Guar gum binders for nanoparticulate silicon battery electrodes*
- 9:40 am **Mark Schulte** *Biocomposites: a novel method for gas to liquid biomanufacturing*

10:00–10:20 am Coffee Break

10:20 am–12:00 pm Oral presentations Session II: Materials

- 10:20 am **Junjie Zhao** *When Metal-organic Frameworks meet Atomic Layer Deposition*
- 10:40 am **Steven Benner** *A Tunable Coarse-Grained Model of Chitosan for Prediction of Solution Behavior*
- 11:00 am **David Rutkowski** *Computational Investigation of Multipolar Colloidal Particles*
- 11:20 am **James Daubert** *Corrosion Protection of Copper Using Atomic Layer Deposition thin Films*
- 11:40 am **Rohan Patil** *Surface Grafted Polymer Assemblies: Understanding the Molecular Weight and Grafting Density Effects using 'Degrafting' as a Strategy*

12:00–1:30 pm Lunch

- 12:35 pm **Dr. Peter Fedkiw** *Announcement of 2015 Stannett Award*
- 12:40 pm **Dr. Richard Spontak** *Announcement of Fall 2015 Praxair Exceptional Teaching Assistant Award*
- 12:45 pm **Keynote Address: Dr. John Weidner**
Chair, University of South Carolina
A Career in Academia: The Best Job Ever!

1:30–3:30 pm Oral presentations Session III: Biotechnology

- 1:30 pm **Carlos Cruz** *Design of Multi-Specific Proteins with Affinity for Solid Surfaces*
- 1:50 pm **Anisur Rahman** *Quantitative analysis of the Akt/mTOR signaling network*
- 2:10 pm **Sophia Carrell** *Shuttling enhances robustness of the DV pattern in Drosophila embryos*
- 2:30 pm **Andrew Loder** *Extreme thermophile metabolic engineering platforms: Production of biofuels and bio-based chemicals at elevated temperatures*
- 2:50 pm **Ahmed Mahmoud Gomaa** *Programmable Killing of Bacterial Strains using CRISPR-Cas Systems*
- 3:10 pm **Garrett Wheaton** *Extreme Thermoacidophiles as Biocatalysts for Heavy Metal Recovery: A Delicate Balance between Biooxidation and Resistance*

3:30–5:00 pm Poster session

5:00–6:00 pm Symposium Mixer



Keynote Presentation

A Career in Academia: The Best Job Ever!

Dr. John W. Weidner

Professor and Chair, Department of Chemical Engineering
University of South Carolina
Columbia, SC 29208

I have been a part of academia since enrolling at the University of Wisconsin in 1980. Fearing that I may never be at a college again, I stretched my stay in Madison out for 6 years. Discovering that someone would pay me to go to graduate school, I enrolled at NC State in 1986 and 30 years later I am still in school. During that time, I have found my job in academia extremely rewarding. The flexibility this career offers has given me the opportunity to work with students from elementary school up through advanced PhD candidates. I have traveled the world working with extremely talented scientists and engineers from diverse backgrounds, and I have worked on a diverse range of exciting research projects. This has indeed been the best job ever! During this presentation I will review my journey through academia, include my sabbaticals at UC-Berkeley, Los Alamos National Laboratories, and Fraunhofer Institute for Solar Energy Systems. I will also present some of my outreach activities, like my work with the FIRST LEGO League, and my research activities in electrochemical engineering. For the latter, I will present my work on the hybrid-sulfur (HyS) process, which is a solar-driven thermochemical cycle for efficiently generating hydrogen on a large scale.

John W. Weidner is Department Chair and Campaign for Excellence Professor of Chemical Engineering at the University of South Carolina (USC). He received his BS degree from the University of Wisconsin-Madison in 1986 and his PhD from NC State University under the direction of Dr. Peter S. Fedkiw in 1991, both in chemical engineering. As a graduate student John received an Electrochemical Society (ECS) Energy Research Summer Fellowship and the Student Research Award from the ECS Battery Division for his dissertation work on the nickel electrode. In 1991, he joined USC as an assistant professor, and in the summer of 1992 he worked with Dr. Gerald Halpert as a NASA Summer Faculty Fellow in the Energy Storage Systems Group at the Jet Propulsion Laboratory in Pasadena, CA. He spent a sabbatical at the University of California-Berkeley working with Professor John Newman in the fall of 1999 and at Los Alamos National Laboratory working with Dr. Tom Zawodzinski in the spring of 2000. His next sabbatical in 2007-08 was spent at the Fraunhofer Institute for Solar Energy Systems in Freiburg, Germany developing advanced catalysts for proton exchange membrane (PEM) electrolyzers for Dr. Christopher Hebling's hydrogen technology group.

Professor Weidner has published 90 refereed journal articles in the field of electrochemical engineering. His research group has created novel synthesis routines for battery materials and electrocatalysts, and they have used a variety of electroanalytical techniques and developed sophisticated mathematical models to advance the fields of electrochemical reactors, advanced batteries, electrochemical capacitors, fuel cells, and electrolyzers. He has directed the research of 18 PhD, 12 Masters students, and 11 postdoctoral associates. John was awarded the Golden Key Faculty Award by USC in 2006 for Excellence in Integrating Undergraduate Teaching and Research for his mentoring of undergraduates. In 2010 he received the Research Award from the ECS Energy Technology Division for his work on his patented PEM electrolyzer for the large-scale production of hydrogen. The University of South Carolina honored him with the USC Educational Foundation Award for Research in Science, Mathematics and Engineering in 2010 and the Joseph M. Biedenbach Service Award in 2014. He was the inaugural Editor of *ECS Transactions* and he is currently a Technical Editor for the *Journal of Electrochemical Society*. He also represents AIChE as a Program Evaluator (PEV) for ABET. He was elected Fellow of ECS in 2010 and Fellow of AIChE in 2015.

List of Poster presentations

Biotechnology

David Chang *Investigation of surfactant-mediated shear protection of mammalian cells for increased bioreactor efficiency*

Jonathan Conway *Role of Extracellular Glycoside Hydrolases from Caldicellulosiruptor Species in Biomass Degradation*

Thomas Jacobsen *Predictable and Tunable Control of Gene Expression in Multicellular Organisms*

Ashton Lavoie *Truly Continuous Purification of Biotherapeutics*

Ryan Leenay *An in vivo, positive screen reveals functional PAM diversity for CRISPR-Cas systems*

Michelle Luo *RNA length affects form and function of the Type I CRISPR-Cas surveillance complex*

Brittany Mertens *Characterization and control of Norovirus interactions and their impact on virus stability and infectivity*

Jamie Nosbisch *Multiscale Modeling of Wound Healing*

Jason Miles *Tuning Surface Assembly of Elastin-Like Polypeptides*

Michael O'Connell *Investigating the Formation of the Dorsal Gradient using Raster Image Correlation Spectroscopy*

Shah Md Toufiqur Rahman *Optogenetic dissection of protein kinase networks*

Jeffrey Zurawski *Chemotactic Systems and Extracellular Enzymes Differentiate Capacity for Plant Biomass Utilization in Caldicellulosiruptor*

Kinetics

Yunfei Gao *Alkali-doped perovskites for oxidative dehydrogenation of ethane under a cyclic redox scheme*

Vasudev Haribal *Oxidative dehydrogenation of ethane under a cyclic redox scheme-Process analysis and comparison*

Dennis Lee *UiO-66-NH₂ Assembly on ALD Oxide Surfaces Using β -cyclodextrin (β -CD) and Cetyltrimethylammonium Bromide (CTAB)*

Amit Mishra *Perovskite Structured Redox Catalysts for Chemical Looping Reforming of Methane*

Mariah Ritz *Ab initio Analysis of Limiting Reactions during selective ALD processes*

Eric Stevens *Thermal ALD of Sn Metal Using SnCl₄ and a Silyl Dihydropyrazine Reducing Agent*

Sara Taylor *Pyrolysis kinetics via molecular-beam mass spectrometry: reactor development and data analysis.*

Seif Yusuf *Manganese Oxide Catalysts for Oxidative Dehydrogenation of Ethane via Chemical Looping*

Materials

Prajesh Adhikari *Self-Supporting Nanodiamond Gels: Elucidating Colloidal Interactions Through Rheology*

Daniel Armstrong *Reprogrammable Shape Memory Using an Electrostatic Polymer Actuator*

Mackenzie Geiger *Introducing Novel Functionalities in Composites using Fumed Silica*

Koohee Han *Directed Assembly and Manipulation of Reconfigurable Structures from Asymmetric Metallo-Dielectric Microcubes*

Amber Hubbard *Self-Folding Polymers: Mimicking Natural Materials*

Sabina Islam *Revisiting the colloidal fundamentals of water-dispersible polymers: Characterization of their nanoscale interactions and correlation to the macroscale phase equilibria*

Ishan Joshipura *Reversible Actuation of Liquid Metals through Microchannels to Enable Soft & Reconfigurable Electronics*

Joseph Lavoie *Tailored Surface Modification of Nonwovens using Fluorochemical Melt Additives*

Chengxiang Liu *Molecular Modeling of Calcium Pyrophosphate Crystallization*

Jennifer Ovental *Production of Zirconium Hydroxide Coatings on Polymer Substrates by Atomic Layer Deposition for Chemical Warfare Agent Degradation*

Dishit Parekh *3D Printing of Room Temperature Liquid Metals for Fabrication of Soft and Flexible Embedded Electronics*

Sangchul Roh *Three dimensional printing by capillary bridging - from sandcastles to silicone rubber*

Tim Shay *Osmotic Platform for Passive and Non-Invasive Sweat Sampling for Biochemical Sensing*

Mohammad Tuhin *Shape-memory Bicomponent Fibers: Investigating the Polymer/Polymer Interface and Adding Sensory Functionality*

Christopher Walker *A Coarse-grained Molecular Dynamics Model for Poly(vinyl butyral) Adhesion to Silica Surfaces*