

Christopher Eugene Shuck

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EDUCATION

- University of Notre Dame** Notre Dame, IN
Ph.D Candidate, Chemical and Biomolecular Engineering 2013-2018 (Expected)
- Thesis: *Microstructure-reactivity Relationship for Gasless High-energy Density Materials*
- Princeton University** Princeton, NJ
B.S.E., Chemical and Biological Engineering 2009-2013
- Certificates in: Engineering Biology, Materials Science and Engineering
 - Thesis: *Desorption Kinetics of Alkali Metal Atoms from Transition Metal Surfaces*

RESEARCH EXPERIENCE

- Fulbright Scholar, **Inorganic Nanomaterials Laboratory** September 2016-June 2017
National University of Science and Technology, Advisor: Alexander Rogachev Moscow, Russia
- Studied the dynamics of phase transition in high-energy density materials
 - Utilized mechanical activation to enhance the chemical reactivity of solid-state reactions
 - Characterized and analyzed solid materials using a variety of experimental techniques
- PhD Intern, **Energetics Research Group** June 2016-September 2016
Lawrence Livermore National Laboratory, Advisor: Robert Reeves Livermore, CA
- Developed a new class of materials: structural energetics for defense applications
 - Coordinated with multiple departments to plan and execute multidisciplinary project
 - Planned and tested new safety procedures relating to energetic material testing
- Doctoral Researcher, **Advanced Nanomaterials Laboratory** October 2013-Present
University of Notre Dame, Advisor: Alexander Mukasyan Notre Dame, IN
- Established five multidisciplinary international collaborations, including two with US national labs
 - Synthesized and characterized heterogeneous nanocomposite particles for new materials synthesis and fundamental understanding of solid state kinetics for combustion systems
 - Negotiated 15% reduction in service contracts saving \$7,500 per year
 - Implemented lab safety program to become only lab that was 100% compliant for five years in a row
 - Mentored 2 graduate students and 3 undergraduate students
- Research Intern, **Princeton Plasma Physics Laboratories** September 2012-June 2013
Princeton University, Advisor: Bruce Koel Princeton, NJ
- Built and maintained ultra high vacuum equipment, including both commercial and custom devices
 - Examined computational and theoretical models to model surface adsorbates
 - Performed experiments to characterize and access liquid lithium surfaces after exposure to plasma
- Research Intern, **Nanobiology and Structural Biology** February 2011-June 2013
Princeton University, Advisor: Janette Carey Princeton, NJ
- Coordinated collaboration, leading to 25% increase in publications between the labs
 - Trained eight students in both experimental and computational techniques
 - Created high-throughput method of protein ion pair interaction quantification

- Determined protein energy landscapes through molecular dynamics studies
- Quantified ligand binding energy computationally and experimentally

PUBLICATIONS

- S. Mukasyan and **C. E. Shuck**, "Kinetics of SHS reactions: A review," *International Journal of Self-Propagating High-Temperature Synthesis*, vol. 26, pp. 145-165, 2018.
- K. V. Manukyan, A. V. Yeghishyan, **C. E. Shuck**, D. O. Moskovskikh, S. Rouvimov, E. E. Wolf, A. S. Mukasyan, "Mesoporous metal-silica materials: Synthesis, catalytic and thermal properties," *Microporous and Mesoporous Materials*, vol. 257, pp. 175-184, 2018.
- A. Salvadori, S. Lee, A. Gillman, K. Matouš, **C. Shuck**, A. Mukasyan, M.T. Beason, I.E. Gunduz, S.F. Son, "Numerical and Experimental Analysis of the Young's Modulus of Cold Compacted Powder Materials," *Mechanics of Materials*, vol. 112, pp. 56-70, 2017.
- **C. E. Shuck** and A. S. Mukasyan "Reactive Ni/Al Nanocomposites: Structural Characteristics and Activation Energy," *The Journal of Physical Chemistry A*, vol. 121, no. 6, pp. 1175–1181, 2017.
- **C. E. Shuck**, J. M. Pauls, A. S. Mukasyan "Ni/Al Energetic Nanocomposites and the Solid Flame Phenomenon," *The Journal of Physical Chemistry C*, vol. 120, no. 47, pp. 27066–27078, 2016.
- **C. E. Shuck**, M. Frazee, A. Gillman, M. T. Beason, I. E. Gunduz, K. Matouš, R. Winarski, A. S. Mukasyan "X-ray nanotomography and focused-ion-beam sectioning for quantitative three-dimensional analysis of nanocomposites," *Journal of Synchrotron Radiation*, vol. 23, no. 4 2016
- K. V. Manukyan, **C. E. Shuck**, M. J. Cherukara, S. Rouvimov, D. Y. Kovalev, A. Strachan, A. S. Mukasyan "Exothermic Self-Sustained Waves with Amorphous Nickel," *Journal of Physical Chemistry C*, vol. 120, no. 10, pp. 5827-5838, 2016
- **C. E. Shuck**, K. V. Manukyan, S. Rouvimov, A. S. Rogachev, A. S. Mukasyan, "Solid flame: Experimental Validation," *Combustion and Flame*, vol. 163, pp. 487-493, 2016.
- K. V. Manukyan, A. G. Avetisyan, **C. E. Shuck**, H. A. Chatilyan, S. Rouvimov, S. L. Kharatyan, and A. S. Mukasyan, "Nickel oxide reduction by hydrogen: Kinetics and structural transformations," *The Journal of Physical Chemistry C*, vol. 119, pp. 16131–16138, 2015.
- K. V. Manukyan, W. Tan, R. J. deBoer, E. J. Stech, A. Aprahamian, M. Wiescher, S. Rouvimov, K. R. Overdeep, **C. E. Shuck**, T. P. Weihs, and A. S. Mukasyan, "Irradiation-enhanced reactivity of multilayer Al/Ni nanomaterials," *ACS Applied Materials and Interfaces*, vol. 7, no. 21, pp. 11272–11279, 2015.
- K. V. Manukyan, **C. E. Shuck**, A. S. Rogachev, and A. S. Mukasyan, "Preparation and reactivity of gasless nanostructured energetic materials," *Journal of Visualized Experiments*, vol. 98, 2015.

PRESENTATIONS

- *Quantitative 3-d Reconstruction of Reactive Nanocomposites: Effect of Nanostructure on Activation Energy* at International Symposium on Self-Propagating High-Temperature Synthesis, 2017
- *3-D Reconstruction of High Energy Density Materials: Effects of Nanostructure on Ignition Characteristic* at 4th Annual Midwest Imaging and Microanalysis Workshop, 2017
- *Reactive Nanocomposites: Surface Contact Area and Activation Energy of Ni-Al* at 3rd International Conference on Nonisothermal Phenomena & Processes, 2017

- Keynote Presentation: *3-D Reconstruction of High Energy Density Materials: Effects of Nanostructure on Ignition Characteristics* at International Symposium on Self-Propagating High-Temperature Synthesis, 2015
- *Solid Flame: Experimental Validation* at American Institute of Chemical Engineers Annual Meeting, 2014
- *Solid Flame: Experimental Validation* At IEEE Annual Mini-symposium on Electron Devices and Photonics, 2014

AWARDS AND FELLOWSHIPS

- Plug & Play Tech Center Startup Camp Award, April 2017
- Best Scientific Report at 3rd International Conference on Nonisothermal Phenomena & Processes, 2017
- Notre Dame Integrated Imaging Facility Award for Best Electron Beam Imaging Publication for 2016
- Fulbright Program, U.S. Department of State, Principal, Russia, 2016
- Carl Storm Underrepresented Minority Fellowship, June 2016
- Graduate Student Union Conference Presentation Grant, April 2016
- California Initiative Fund Recipient, April 2016
- 2nd Place for the Notre Dame Graduate Student Union Symposium Oral presentation, April 2016
- Oliver Langenberg '35 Scholarship, 2013
- Charles Lockhart Scholarship 2010-2013
- William Randolph Heart Scholarship 2010-2011

BUSINESS EXPERIENCE

- McCloskey Business Plan Competition, Team Leader** 2015-2017
- Founded and managed a team of students, including Ph.D. and MBA students
 - Conducted market research, developed an original solution to the problem, and wrote a business plan detailing all aspects of the business
 - Placed in the finals during the 2016-2017 competition, receiving the Plug & Play Tech Center Startup Camp Award (\$75,000)
- Scientific Entrepreneurship, Business Class** Spring 2016
- Course in taking an invention to market, including market research, and writing a business plan

LEADERSHIP EXPERIENCE

- International Program, Campus Ambassador** 2015-Present
- Facilitated over twenty programs designed to for entire (1400+) international student body
 - Led workshops for incoming international students including visas, finances, and transportation
- Graduate Student Union, Department Representative** 2014-Present
- Influenced campus-wide events and spending, directly led to 15% increased yearly budget
 - Acted as liaison between administration and student body, leading 300% increase in events
- Princeton Alumni Interviewer** 2013-Present
- Interviewed over 75 students for admission into Princeton, 15 times the national average
- Colonial Club, Treasurer** 2011-2013
- Executed promotions which led to 100% increase in membership, while reducing expenses by 10%

- Managed team of 18 officers to plan, advertise, and execute events

Outdoor Action, Trip Leader

2010-2013

- Coordinated freshmen orientation program with over 60% of incoming students participating
- Lead a group of 10-12 freshmen on a wilderness trip; regulate supplies, plan route, report to command daily

TEACHING EXPERIENCE

University of Notre Dame

2013-2015

- Chemical Engineering Thermodynamics (Required for Sophomores, over 100 students)
- Advanced Chemical Reaction Engineering (Graduate level course, including theory and computation)
- Chemical Engineering Laboratory I (Junior lab course, managed four experiments)
- Chemical Engineering Laboratory II (Senior lab course, managed four experiments)

OTHER

Languages: Intermediate Russian
 Computer Skills: Matlab, Mathematica, Java, Python, SQL, Microsoft Office
 Experimental Techniques: High-temperature High-pressure experiments, Focused Ion Beam (FIB) Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Synchrotron X-Ray Nanotomography, X-Ray Diffraction (XRD), Electrothermal Explosion (ETE), Differential Scanning Calorimetry (DSC), Mechanical Activation (MA), High-energy Ball-milling (HEBM), AvizoFire 3D Analysis, X-ray photoelectron spectroscopy (XPS), Auger electron spectroscopy (AES), Ultra-High Vacuum (UHV) experiments
 Interests: Backpacking, Running, Football, Soccer, Volleyball, Travel