

# Christopher Eugene Shuck

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## EDUCATION

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**University of Notre Dame** Notre Dame, IN  
Ph.D., Chemical and Biomolecular Engineering 2013-2017

- 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

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Research Assistant Professor, **Drexel Nanomaterials Institute** Aug. 2021-Current  
*Drexel University* Advisor: Yury Gogotsi Philadelphia, PA

- Responsible for multiple successfully funded grants (\$850,000) from American (NSF) and international (European commission) agencies.
- Develop and teach full major-required courses in Materials Science and Engineering department.
- Pioneer research into novel MAX and MXenes, spanning nearly the entire periodic table, leading to new applications in biomedicine, electrochemical energy storage, catalysis, functional fabrics, and electromagnetic interference shielding.
- Develop strategies to scale up 2D material synthesis from g to kg-scale using cheaper, green precursors for commercial and governmental use.
- Advise graduate (Masters, Ph.D., visiting foreign students) and undergraduate students (co-op, senior design, freshmen) in developing original research plans, leading to multiple publications and awards
- Manage multiple grants from industrial and governmental organizations, including organizing, planning, and executing research directions, organizing budget and funding, and ensuring that reporting and milestones are completed.
- Take part in hiring and training of administrative staff, graduate students, and lab personnel.

Postdoctoral Researcher, **Drexel Nanomaterials Institute** Mar. 2018-Aug. 2021  
*Drexel University* Advisor: Yury Gogotsi Philadelphia, PA

- Develop and plan research directions focusing on synthesis of new MXenes for energy storage, electromagnetic shielding, and electrochromic devices.
- Study the relationship between synthesis-structure-property of the MAX-MXene family of materials
- Pioneer research into compositional solid solution MXenes.
- Apply for and manage multiple grants (DOE, IARPA, NSF, ARO, etc.).
- Advise multiple Ph.D., undergraduate, and high school students. Implement customized research directions for each student, depending on their interests, skills, and talents.
- Developed a weeklong “MXene Synthesis, Processing, and Characterization” course with >300 participants over two years, bringing in >\$150,000 to the MSE department.

Doctoral Researcher, **Advanced Nanomaterials Laboratory** Oct. 2013-Feb. 2018  
*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.
- Managed microscopy facilities, including training new users for SEM usage and performing maintenance on SEMs.
- 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.

Fulbright Scholar, **Inorganic Nanomaterials Laboratory** Sept. 2016-Jun. 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.
- Led workshops dedicated to scientific English language, writing, and speaking skills.

PhD Intern, **Energetics Research Group** Jun. 2016-Sept. 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.

Research Intern, **Princeton Plasma Physics Laboratories** Sept. 2012-Jun. 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 assess liquid lithium surfaces after exposure to plasma.

Research Intern, **Nanobiology and Structural Biology** Feb. 2011-Jun. 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.

Research Intern, **Structural Biology Lab** May 2012-Sept. 2012  
*Princeton University*, Advisor: Rudiger Ettrich Nove Hradý, CZ

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

## PUBLICATIONS

1. M. A. Unal, F. Bayrakdar, L. Fusco, O. Besbinar, **C. E. Shuck**, S. Yalcin, M. T. Erken, A. Ozkul, C. Gurcan, O. Panatli, G. Y. Summak, C. Gokce, M. Orecchioni, A. Gazzi, F. Vitale, J. Somers, E. Demir, S. S. Yildiz, H. Nazir, J. Grivel, D. Bedognetti, A. Crisanti, K. C. Akcali, Y. Gogotsi, L. G. Delogu, A. Yilmazer, "2D MXenes with Antiviral and Immunomodulatory Properties: A Pilot Study Against SARS-CoV-2" *Nano Today*, vol. 38, pp. 101136, 2021.
2. K. Maleski, **C. E. Shuck**, A. T. Fafarman, and Y. Gogotsi, "The Broad Chromatic Range of Two-Dimensional Transition Metal Carbides (MXenes) and its Electronic Origins," *Advanced Optical Materials*, vol. 9, pp. 2001563, 2021.

3. M. Shekhirev\*, **C. E. Shuck\***, A. Sarycheva and Y. Gogotsi, "Characterization of MXenes at Every Step, from Their Precursors to Single Flakes and Assembled Films," *Progress in Materials Science*, vol. 120, pp. 100757, 2021.
4. L. Wang, M. Han, **C. E. Shuck**, X. Wang, and Y. Gogotsi, "Adjustable Electrochemical Properties of Solid-Solution MXenes," *Nano Energy*, vol. 88, pp. 106308, 2021.
5. J. Wu, Q. Li, **C. E. Shuck**, K. Maleski, H. N. Alshareef, J. Zhou, Y. Gogotsi, and L. Huang, "An Aqueous 2.1 V Pseudocapacitor with MXene and V-MnO<sub>2</sub> Electrodes," *Nano Research*, DOI: 10.1007/s12274-021-3513-x
6. T. S. Mathis, K. Maleski, A. Goad, A. Sarycheva, M. Anayee, A. C. Foucher, K. Hantanasirisakul, **C. E. Shuck**, E. A. Stach, and Y. Gogotsi, "Modified MAX Phase Synthesis for Environmentally Stable and Highly Conductive Ti<sub>3</sub>C<sub>2</sub> MXene," *ACS Nano*, vol. 15, pp. 6420-6429, 2021.
7. **C. E. Shuck**, K. Ventura-Martinez, A. Goad, S. Uzun, M. Shekhirev, and Y. Gogotsi "Safe Synthesis of MAX and MXene: Guidelines to Reduce Risk During Synthesis" *ACS Chemical Health & Safety*, DOI: 10.1021/acs.chas.1c00051
8. J. Li, X. Wang, W. Sun, K. Maleski, **C. E. Shuck**, K. Li, P. Urbankowski, K. Hantanasirisakul, X. Wang, P. Kent, H. Wang, and Y. Gogotsi, "Intercalation Induced Reversible Electrochromic Behavior of Two-dimensional Ti<sub>3</sub>C<sub>2</sub>T<sub>x</sub> MXene in Organic Electrolytes," *ChemElectroChem*, vol. 8, pp. 151-156, 2021.
9. P. Singh, B. Akuzum, **C. E. Shuck**, K. Pal, Y. Gogotsi, E. C. Kumbur "MXene-based Suspension Electrode with Improved Energy Density for Electrochemical Flow Capacitors," *Journal of Power Sources*, vol. 506, pp. 230187, 2021.
10. M. Elanchezian, M. Eswaran, **C. E. Shuck**, S. Senthilkumar, S. Elumalai, R. Dhanusuraman, and V. K. Ponnusamy, "Facile Synthesis of Polyaniline/Titanium Carbide (MXene) Nanosheets/Palladium Nanocomposite for Efficient Electrocatalytic Oxidation of Methanol for Fuel Cell Application," *Fuel*, vol. 303, pp. 121329, 2021.
11. P. Ridley, C. Gallano, R. Andris, **C. E. Shuck**, Y. Gogotsi, and E. Pomerantseva, MXene-Derived Bilayered Vanadium Oxides with Enhanced Stability in Li-Ion Batteries, *ACS Applied Energy Materials*, vol. 3, pp. 10892-10901, 2020.
12. M. Han\*, K. Maleski\*, **C. E. Shuck\***, Y. Yang, J. T. Glazar, A. C. Foucher, K. Hantanasirisakul, A. Sarycheva, N. C. Frey, S. J. May, V. B. Shenoy, E. A. Stach, and Y. Gogotsi "Tailoring Electronic and Optical Properties of MXenes through Forming Solid Solutions," *Journal of the American Chemical Society*, vol. 142, pp. 19110-19118, 2020.
13. D. O. Moskovskikh, S. Vorotilo, V. S. Buinevich, A. S. Sedegov, K. V. Kuskov, **C. E. Shuck**, M. Zhukovskiy, and A. S. Mukasyan, "Fabrication of Extremely Hard and Tough Bulk High-Entropy Nitride Ceramics (HfZrTaNbTi)N," *Scientific Reports*, vol. 10, 2020.
14. Q. Zhao, M. Seredych, E. Precetti, **C. E. Shuck**, M. Harhay, R. Pang, C. Shan, and Y. Gogotsi "Adsorption of Uremic Toxins Using Ti<sub>3</sub>C<sub>2</sub>T<sub>x</sub> MXene for Dialysate Regeneration," *ACS Nano*, vol. 14, pp. 11787-11798, 2020.
15. **C. E. Shuck** and Y. Gogotsi, "Taking MXenes from the Lab to Commercial Products" *Chemical Engineering Journal*, vol. 401, pp. 125786, 2020.
16. **C. E. Shuck** and Y. Gogotsi, "MXenes: A Tunable Family of 2D Carbides and Nitrides with Diverse Applications" *Material Matters*, vol. 25, pp. 3-8, 2020.
17. D. Pinto, B. Anasori, H. Avireddy, **C. E. Shuck**, K. Hantanasirisakul, G. Deysheer, J. R. Morante, W. Porzio, H. N. Alshareef, and Y. Gogotsi, "Synthesis and Electrochemical Properties of 2D Molybdenum Vanadium Carbides – Solid Solution MXenes," *Journal of Materials Chemistry A*, vol. 8, pp. 8957-8968, 2020.
18. M. Han, **C. E. Shuck**, R. Rakhmanov, D. Parchment, B. Anasori, C. M. Koo, G. Friedman, and Y. Gogotsi, "Beyond Ti<sub>3</sub>C<sub>2</sub>T<sub>x</sub>: MXenes for Electromagnetic Interference Shielding," *ACS Nano*, vol. 14, pp. 5008-5016, 2020.

19. L. Li, X. Fu, S. Chen, S. Uzun, A. Levitt, **C. E. Shuck**, W. Han, and Y. Gogotsi, "Hydrophobic and Stable MXene-polymer Pressure Sensors for Wearable Electronics," *ACS Applied Materials & Interfaces*, vol. 12, pp. 15362-15369, 2020.
20. J. Zhang, S. Uzun, S. Seyedin, P. Lynch, B. Akuzum, Z. Wang, S. Qin, M. Alhabeab, **C. E. Shuck**, W. Lei, E. Kumbur, W. Yang, X. Wang, G. Dion, and Y. Gogotsi, "MXene Liquid Crystals and Fibers," *ACS Central Science*, vol. 6, pp. 254-265, 2020.
21. **C. E. Shuck**, A. Sarycheva, M. Anayee, A. Levitt, Y. Zhu, S. Uzun, V. Balitskiy, V. Zahrodna, O. Gogotsi, and Y. Gogotsi, "Scalable Synthesis of  $Ti_3C_2T_x$  MXene," *Advanced Engineering Materials*, vol. 22, pp. 1901241, 2020.
22. G. Deysher, **C. E. Shuck**, N. Frey, A. Foucher, K. Maleski, A. Sarycheva, V. Shenoy, E. Stach, B. Anasori, and Y. Gogotsi, "Synthesis of  $Mo_4VAIC_4$  MAX Phase and Two-Dimensional  $Mo_4VC_4$  MXene with Five Atomic Layers of Transition Metals," *ACS Nano*, vol. 14, pp. 204-217, 2020.
23. W. Bao\*, **C. E. Shuck\***, W. Zhang, X. Guo, Y. Gogotsi, and G. Wang, "Boosting Performance of Na-S Batteries Using Sulfur-Doped  $Ti_3C_2T_x$  MXene Nanosheets with a Strong Affinity to Sodium Polysulfides," *ACS Nano*, vol. 13, pp. 11500-11509, 2019.
24. **C. E. Shuck**, M. Han, K. Maleski, K. Hantanasirisakul, S. J. Kim, J. Choi, W. Reil, and Y. Gogotsi, "Effect of  $Ti_3AlC_2$  MAX Phase on Structure and Properties of Resultant  $Ti_3C_2T_x$  MXene," *ACS Applied Nano Materials*, vol. 2, pp. 3368-3376, 2019.
25. J. Li, L. An, H. Li, J. Sun, **C. Shuck**, X. Wang, Y. Shao, Y. Li, Q. Zhang, and H. Wang, "Tunable Stable Operating Potential Window for High-Voltage Aqueous Supercapacitors," *Nano Energy*, vol. 63, pp. 103848, 2019.
26. J. M. Pauls, **C. E. Shuck**, A. Genç, S. Rouvimov, and A.S. Mukasyan, "In-situ Transmission Electron Microscopy Determination of Solid-State Diffusion Kinetics in the Aluminum-Nickel System," *Journal of Solid State Chemistry*, vol. 276, pp. 114-121, 2019.
27. M. Seredych, **C. E. Shuck**, D. Pinto, M. Alhabeab, E. Precetti, G. Deysher, B. Anasori, N. Kurra, and Y. Gogotsi, "High-Temperature Behavior and Surface Chemistry of Carbide MXenes Studied by Thermal Analysis," *Chemistry of Materials*, vol. 31, pp. 3324-3332, 2019.
28. L. Yang, Y. Dall'Agnesse, K. Hantanasirisakul, **C. E. Shuck**, K. Maleski, M. Alhabeab, G. Chen, Y. Gao, Y. Sanehira, A. K. Jena, L. Shen, C. Dall'Agnesse, X.-F. Wang, and Y. Gogotsi, and T. Miyasaka, " $SnO_2$ - $Ti_3C_2$  MXene Electron Transport Layers for Perovskite Solar Cells," *Journal of Materials Chemistry A*, vol. 7, pp. 5635-5642, 2019.
29. P. Salles, D. Pinto, K. Hantanasirisakul, K. Maleski, **C. E. Shuck**, and Y. Gogotsi, "Electrochromic Effect in Titanium Carbide MXene Thin Films Produced by Dip-Coating," *Advanced Functional Materials*, vol. 29, pp. 1809223, 2019.
30. Q. Shan, X. Mu, M. Alhabeab, **C. E. Shuck**, D. Pang, X. Zhao, X. F. Chu, Y. Wei, F. Du, G. Chen, Y. Gogotsi, Y. Gao, and Y. Dall'Agnesse, "Two-Dimensional Vanadium Carbide ( $V_2C$ ) MXene as Electrode for Supercapacitors with Aqueous Electrolytes," *Electrochemistry Communications*, vol. 96, pp. 103-107, 2018.
31. K. Manukyan, J. Pauls, **C. Shuck**, S. Rouvimov, A. Mukasyan, K. Nazaretyan, H. Chatilyan, and S. Kharatyan, "Kinetics and Mechanism of Ignition in Reactive Al/Ni Nanostructured Materials," *The Journal of Physical Chemistry C*, vol. 122, pp. 27082-27092, 2018.
32. A. S. Mukasyan, **C. E. Shuck**, J. M. Pauls, K. V. Manukyan, D. O. Moskovskikh, and A. S. Rogachev, "The Solid Flame Phenomenon: A Novel Perspective," *Advanced Engineering Materials*, vol. 20, pp. 1701065, 2018.
33. J. M. Pauls, **C. E. Shuck**, and A. S. Mukasyan, "Micro-Heterogeneous Regimes for Gasless Combustion of Composite Materials," *Combustion Science and Technology*, vol. 190, pp. 893-908, 2018.
34. **C. E. Shuck** and A. S. Mukasyan, "Kinetics of Heterogeneous Self-Propagating High-Temperature Reactions" *Advanced Chemical Kinetics*, pp. 167-196, 2018.

35. A. 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.
36. K. V. Manukyan, A. V. Yeghishyan, **C. E. Shuck**, D. O. Moskovskikh, S. Rouvimov, E. E. Wolf, and A. S. Mukasyan, "Mesoporous Metal-Silica Materials: Synthesis, Catalytic and Thermal Properties," *Microporous and Mesoporous Materials*, vol. 257, pp. 175-184, 2018.
37. A. Salvadori, S. Lee, A. Gillman, K. Matouš, **C. Shuck**, A. Mukasyan, M.T. Beason, I.E. Gunduz, and 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.
38. **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.
39. **C. E. Shuck**, J. M. Pauls, and 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.
40. **C. E. Shuck**, M. Frazee, A. Gillman, M. T. Beason, I. E. Gunduz, K. Matouš, R. Winarski, and 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
41. K. V. Manukyan, **C. E. Shuck**, M. J. Cherukara, S. Rouvimov, D. Y. Kovalev, A. Strachan, and A. S. Mukasyan "Exothermic Self-Sustained Waves with Amorphous Nickel," *Journal of Physical Chemistry C*, vol. 120, no. 10, pp. 5827-5838, 2016
42. **C. E. Shuck**, K. V. Manukyan, S. Rouvimov, A. S. Rogachev, and A. S. Mukasyan, "Solid flame: Experimental Validation," *Combustion and Flame*, *Combustion and Flame*, vol. 163, pp. 487-493, 2016.
43. 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.
44. 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.
45. 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.

## FUNDED GRANTS

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- NSF-Ceramics, \$600,000, award: 2041050, 2021-2025; co-wrote with Yury Gogotsi (Drexel University)
- European Commission – Marie Curie, \$250,000, award: 101029140, 2021-2023; co-wrote with Yury Gogotsi (Drexel University) and Lucia Gemma Delogu (University of Padua)

## ORAL PRESENTATIONS

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- **Keynote Presentation:** *MXenes: 2D Transition Metal Carbides and Nitrides*, International Virtual Conference on Materials Research, 2021
- **Invited Presentation:** *Novel Applications and Properties of MXenes*, International Conference on Advanced Materials and Mechanical Characterization, 2021
- **Invited Seminar:** *MXenes: 2D Transition Metal Carbides and Nitrides*, University of Duisburg-Essen Physics Seminar Series, 2020
- **Nominated Presentation:** *MAX Phases as Precursors to New MXenes*, North American Materials Colloquium Series, 2020
- **Keynote Presentation:** *MAX Phases as Precursors to New MXenes*, International workshop on functional MAX-materials, 2020

- *Mo<sub>4</sub>VC<sub>4</sub>: a Two-dimensional MXene with 5 Atomic Layers of Transition Metals*, CIMTEC 2020 (Canceled due to COVID-19)
- *Scalable Synthesis of Ti<sub>3</sub>C<sub>2</sub>T<sub>x</sub> MXenes*, at Materials Research Society Spring Meeting, 2020 (Canceled due to COVID-19)
- *Mo<sub>4</sub>VC<sub>4</sub>: a Two-dimensional MXene with 5 Atomic Layers of Transition Metals*, Beilstein Institute 2019
- *Effect of MAX Phase Synthesis on Resultant MXene Properties* at Materials Research Society Fall Meeting, 2018
- *Quantitative 3D 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 4<sup>th</sup> 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:** *3D 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

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- Steinbright Career Development Center Award (\$20,000), 2021
- Steinbright Career Development Center Award (\$7,250), 2020
- Outstanding Dissertation Award (Given to the top graduating PhD student in the department), 2018
- 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
- 2<sup>nd</sup> 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

## TEACHING/OUTREACH EXPERIENCE

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### Drexel University

- MATE 280 Advanced Materials Laboratory (Instructor of record, 20+) 2021
- MXene Synthesis, Processing, and Characterization (Lead Instructor, 75+) 2020-2021
- ENGR220 Fundamentals of Materials (Recitation Instructor, 30 students) 2020
- ASM Materials Camp (Introduction to Materials Science, 45 students) 2019
- MATE-200 (Introduction to Materials Science, 75 students) 2019
- Drexel Emerging Graduate Scholars (Conference for PhD Students, 300+) 2018-2020
- Drexel Senior Design Projects (Mentor, 9 students) 2018-2020

- Drexel Co-op Program (Mentor, 6 students) 2018-2020

### 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)

## BUSINESS EXPERIENCE

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### 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)

## LEADERSHIP EXPERIENCE

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### Drexel Co-op Program, *Mentor*

2018-Present

- Hired, trained, and managed six Drexel undergraduate students to perform independent, individualized research projects
- Received \$27,250 funding (only 4 awards given university-wide per year) for original research project
- Student Outcomes:
  - Grayson Deysher: 3 Publications, Currently in PhD program at UCSD
  - Nicolas Trainor: Currently in PhD program at Penn State
  - William Reil: 1 Publication, Current Undergraduate
  - Kimberly Ventura-Martinez: Co-writing 2 publications, Current Undergraduate, Won Bruce and Cynthia Maryanoff Endowed Research Prize
  - Jonathan Shochat: Co-writing 1 publication, Current Undergraduate
  - Yuanzhe Zhu: 1 Publication, Current Undergraduate

### Drexel Senior Design Projects, *Mentor*

2018-Present

- Proposed research plans serving as the senior project for Drexel undergraduates
  - $Ti_3C_2T_x$  MXene Production Plant: Four chemical engineering undergraduate students designed an industrial-sized production plant for MXene synthesis. The group was selected as the top senior design group in the chemical engineering department
  - Synthesis and Electrochemical Properties of Molten Salt MXenes: Four materials science undergraduate students will use a new molten salt approach to synthesize a variety of MXene chemistries with tailored surface chemistry. This project is ongoing.
  - Screening of MXenes for Photothermal Therapy: An interdisciplinary group of two students will focus on determining which MXene will have the highest light to heat conversion, while being biocompatible. This project is ongoing.

### Materials Research Society, *Government Affairs Committee*

2019-Present

- Worked with the grassroots subcommittee to facilitate communication between the MRS community and national legislators
- Encouraged members to write personalized letters to national legislators to advocate for materials research

**MXene Symposium, Organizer**

2019

- Organized a symposium for 200+ attendees, including contacting and coordinating with presenters, managing accommodations, providing meals for all attendees, and organizing a sub-poster session within the symposium

**International Program, Campus Ambassador**

2015-2018

- 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**

2014-2016

- 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