

CURRICULUM VITAE

Joseph Furgal, Ph.D.

Contact Information

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I. Academic Degrees

2015 Ph.D. University of Michigan, Ann Arbor, MI, Materials Chemistry
2012 M.S. University of Michigan, Ann Arbor, MI, Chemistry
2010 B.S. University of Detroit Mercy, Detroit, MI, Major: Chemistry, Minor: Math

II. Academic Positions

8/17-Present Assistant Professor, Bowling Green State University, Chemistry
6/15-7/17 Postdoctoral Research Fellow, University of Michigan, Chemical Engineering, Advisor: Timothy Scott
9/10-5/15 Graduate Student Research Assistant, University of Michigan, Chemistry, Advisors: Theodore Goodson III (Chemistry) and Richard Laine (Materials Science and Engineering)
6/09-8/09 Snyder Research Fellow, University of Illinois Urbana Champaign, Organic Chemistry Department, Advisor: Jeffrey Moore
9/07-5/10 Undergraduate Research Assistant, University of Detroit Mercy, Chemistry, Advisor: Matthew Mio

III. Non-academic Positions

N/A

IV. Teaching Experiences

A. Undergraduate Courses:

Organic Chemistry II (Chem 3440, Spring 2019, @BGSU)
Organic Chemistry II (Chem 3440, Spring 2020, @BGSU)
Organic Chemistry II (Chem 3440, Spring 2021, @BGSU)
Organic Chemistry II (Chem 3440, Spring 2022, @BGSU)
Independent Study Undergraduate Research (Chem 4130, Fall 2017, Spring 2018, Fall 2018, Spring 2019, Fall 2020, Spring 2021, Fall 2021, Spring 2022 w/honors Spring 2018, Spring 2021, Fall 2021, Spring 2022 @BGSU)

B. Undergraduate-Graduate Courses:

Spectroscopic Methods in Organic Chemistry (Chem 4660/5660, Fall 2021, @BGSU)
Spectroscopic Methods in Organic Chemistry (Chem 4660/5660, Fall 2020, @BGSU)
Spectroscopic Methods in Organic Chemistry (Chem 4660/5660, Fall 2019, @BGSU)
Spectroscopic Methods in Organic Chemistry (Chem 4660/5660, Fall 2018, @BGSU)

Spectroscopic Methods in Organic Chemistry (Chem 4660/5660, Fall 2017, @BGSU)

C. Graduate Courses:

Special Topics in Chemistry: Polymer Chemistry (@Detroit Mercy 2016, Chem 6010)

D. Other Teaching: -Polymer Bootcamp Workshop Aug 2019 (1 Day)

-Workshop on Using Fluoride to Transform Silicon Materials Dec 2022

E. Thesis and Dissertation Students:

Serve as PhD. Thesis Advisor

<u>Name</u>	<u>Degree</u>	<u>Year</u>	<u>University</u>
Buddhima Rupasinghe ^a	PhD.	Feb 17, 2022	BGSU
Nai-hsuan Hu ^b	PhD.	Mar 15, 2022	BGSU
Shahrea Mahbub ^c	PhD.	Jun 22, 2022	BGSU
Herenia Armenta ^d	PhD.	In Progress	BGSU
Mahmud Rashed ^e	PhD.	In Progress	BGSU
Cory Sims ^f	PhD.	In Progress	BGSU
Mehdi Erfani Jazi ^f	PhD.	In Progress	BGSU
Kyle Hallowell ^f	PhD.	In Progress	BGSU

Notes: ^aExcellence in Graduate Poly Research 2021 (ACS POLY), Shanklin Excellence in Graduate Research Award (1st place 2022), Now at Charles River Lasb, Family with 3 kids; ^bExcellence in Graduate Poly Research 2019 (ACS POLY), Taller Fellowship, Shanklin Excellence in Graduate Research Award (1st place 2021), Invited Lecture 2021 Silicon Containing Polymers and Composites, now at Formlabs Inc.; ^cMcMaster Fellowship 2021-22, Invited Lecture 2021 Silicon Containing Polymers and Composites; ^dCo-Best Poster 2021 Silicon Containing Polymer and Composites Meeting; ^eCo-Best Poster 2021 Silicon Containing Polymer and Composites Meeting, Family with 4 kids, ^fFamilies with 1 kid each.

Serve as Undergraduate Research Mentor

<u>Name</u>	<u>Degree</u>	<u>Year</u>	<u>University</u>
Rachel Bianculli ^a	B.S. CHEM (Honors)	2018	BGSU
Matvey Kochurin	REU	2018	St. Petersburg St. RUS
Timothy May ^b	B.S. HHS	2019	BGSU
Zachary Miller	B.S. HHS	2019	BGSU
Raed Farraj	REU	2019	UDM
Matthew Waldick ^c	B.S. CHEM	2020	BGSU
Christian Arnold	B.S. BIO	2020	BGSU
Elizabeth Massien ^d	B.S. CHEM	2021	BGSU
Bailey Alspach	B.S.	2021	BGSU
Connor Owen	B.S. CHEM	2022	BGSU
Kathryn Haver ^e	B.S. CHEM (Honors)	2022	BGSU
Sabryna Creech	B.S.	2021	BGSU
Ashley Greene	B.S. CHEM	In Progress	BGSU
Bianca Soper	B.S. CHEM	In Progress	BGSU
Kyle Hallowell ^f	B.S. BIO	2022	BGSU
Tyler Schrand	B.S. BIO	In Progress	BGSU
Baileigh Laipply ^g	B.S. BIO (Honors)	2021	BGSU
Kyle Walny ^h	B.S. BIO (Honors)	2021	BGSU

Kristan Major ⁱ	REU	2022	CSU
Lavano Sands ⁱ	REU	2022	CSU

Notes: ^aPhD Candidate Chemistry Virginia Tech, ^bMasters at Mercyhurst University, ^cFort Amanda Specialties, ^dThe Garland Company, ^eHonors project co-advisor, ^fNow PhD student in Photochemical Sciences BGSU, ^gHonors project co-advisor with Julia Halo, ^hHonors project co-advisor with Ray Larsen, ⁱCentral State University (HBCU) REU-LEAPS.

Serve as PICNICS High School Summer Research Mentor

<u>Name</u>	<u>Degree</u>	<u>Year</u>	<u>University</u>
Nathan Hershberger	High School	2018	BGSU
Olivia Thomas	High School	2019	BGSU
Tressa Greiner	High School	2019	BGSU
Mariah Hahn	High School	2021	BGSU

Serve as Postdoctoral Research Mentor

<u>Name</u>	<u>Degree</u>	<u>Year</u>	<u>University</u>
Chamika Lenora ^a	PhD.	2020	BGSU

Notes: ^aNow at Taiwan Semiconductor Corporation., Arizona, USA, PhD. Wayne State University

Serve as Committee Member

Member Ph.D. Thesis Committee

<u>Name</u>	<u>Degree</u>	<u>Year</u>	<u>University</u>
Sarvar Rakhimov	PhD.	In Progress	BGSU
Ankit Dara	PhD.	In Progress	BGSU
Chathurri Wasapama	PhD.	In Progress	BGSU
Fengdan Zhao	PhD.	2021	BGSU
Kaustav Dey	PhD.	2021	BGSU
Lorena Alvarez	PhD.	In Progress	BGSU
Carina Hadad	PhD.	2022	BGSU
Travis Green	PhD.	2020	BGSU
Nick May	PhD.	2022	BGSU
Claire Smith	PhD.	2021	BGSU
Noalick Aboa	PhD.	In Progress	BGSU
Mengchen Liao	PhD.	2021	McMaster U CAN
Jiamin Huang	PhD.	In Progress	BGSU
Katie Perkins	PhD.	In Progress	BGSU
Irene Baraza	PhD.	In Progress	BGSU

Curriculum Development

A. Courses

Course Revision(s), Bowling Green State University, Switched the online Chem 3440 (Organic II) lecture to a flipped classroom teaching methodology by splitting the lecture topics into a series of tutorial videos with questions to watch and answer before each class period. In each class we go over problems, have group breakout sessions and thought experiments on the hows and whys of organic structure and mechanism. (W2020)

Course Revision (s), Bowling Green State University, Developed a hybrid organic spectroscopy class (CHEM 4660/5660) into a completely hands on Community Based Learning Course, where students used the spectroscopic analysis skills learned in class to help multiple companies solve problems: PBE in Bowling Green, OH (on the analysis of incontinence products urine uptake and chemical makeup), Crescent Manufacturing in Fremont, OH (analysis of razor blade coating efficiency and chemical makeup), Master Fluid Solutions in Perrysburg, OH (analysis of an unknown solid compound being formed in their cutting fluid solutions and clogging pipes), and Spectra-Photopolymer in Millbury, OH (Analysis and determination of impurities in a series of commercial acrylate monomers that were giving different rheological properties despite having the same CAS number). These opportunities give students hands on and real-world experience working with companies during their studies. *This project was funded by an NSF SEA Change Venture Award (F2020) and highlighted by the Toledo Blade W2020. (F2019-F2021)*

Course Revision(s), Bowling Green State University, Developed a collaboration project with Michelle Haff Brodke at Firelands campus to work on a contamination problem at an injection molding company (Ventra) in Sandusky. Chem 5660 was involved in this project (F2018).

Course Revision(s), Bowling Green State University: Added a semi-laboratory component to Chem 5660/4660 to include students taking their own FTIR, NMR, Mass Spec (F2018).

Course Revision(s), Bowling Green State University: Added hands on software instruction into the CHEM 4660/5660 curriculum to familiarize students with NMR and Mass Spectrum processing (F2017).

Courses Development: Polymer Chemistry course based on that taught at University of Detroit Mercy in 2016 (Su2016)

B. Workshops:

Developer of Polymer Bootcamp at BGSU to introduce polymer chemistry and physics topics over a full day workshop to graduate and undergraduate students, August 16, 2019

Co-Chair Planning Committee for the 2021 Silicon Containing Polymers and Composites Workshop (International, ACS Poly Sponsored, San Diego, CA Dec 1-4, 2021), Taught a session on using fluoride to transform silicon-based materials

C. Educational Materials: See paper on Polymer Chemistry Course in Publications

V. Professional Development

2021 Silicon Containing Polymers and Composites Workshop San Diego, CA Dec 1-4, 2021
2020 4th International Symposium on Silsesquioxane Functional Materials, (Korea), Remote
2020 ACS Fall National Meeting-Silicon-based Materials Today, Tomorrow & Future, Remote
2019 Next Generation Smart Materials Workshop, Savannah, Georgia

2019 BGSU Allies, Bowling Green, Ohio
2018 Silicon Containing Polymers and Composites Workshop, San Diego, California
2018 BGSU Faculty Mentoring Program, Bowling Green, Ohio
2018 NSF-CHE Early Career Workshop, Alexandria, Virginia
2017 NSF Grants Conference, Phoenix, Arizona
2017 Cottrell Scholars Active Teaching Workshop, Washington, D.C.

VI. Academic Advising:

a. Undergraduate students (research)

2022 6 advisees
2021 8 advisees
2020 5 advisees
2019 2 advisees
2018 3 advisees
2017 1 advisee

b. Graduate students

2022 7 advisees
2021 7 advisees
2020 6 advisees
2019 5 advisees
2018 3 advisees
2017 0 advisees

VIII. Research Interests

Our research interests are focused on the development of active-silicon based materials (i.e. silsesquioxanes and siloxanes) and understanding how they interact with light through making and breaking bonds, actuation, and absorption and emission properties. We are specifically interested in developing self-healable coatings, artificial muscles, environmental remediation, improving difficult separations, and tailoring of siloxane building blocks through chemical and physical understanding to achieve these goals.

IX. Research Projects and Grants

A. Ongoing Projects

08/17-Current Collaboration project co-developed with Prof Alexis Ostrowski (Chemistry, BGSU) The project consists of the development of numerous dynamic metal coordination hybrid polymer systems, their characterization and analysis of the imbued materials mechanical properties. This project also includes other dynamic covalent methodologies and their incorporation into siloxanes for self-healing applications (1 current graduate student: Herenia Espitia Armenta; 1 current undergraduate student: Bianca Soper), 1 manuscript in preparation.

01/18-Current Fundamental research on porous silsesquioxane polymers including pore size and surface area control in addition to the development of a system that reversibly shrinks and expands on-demand with light (using modified azobenzene derivatives incorporated into a naturally derived Q-type silica cage (silsesquioxane) core ($Q_8M_8^H$)). These materials show reversible light driven response and can expel non-polar fluids such as toluene with overall shrinkage to ~80% of their total volume as observed by microscopy and dynamic mechanical analysis with UV (365 nm) light. The process can be reversed by using visible light so the sponge can be reused. They can also be dried out and reswollen multiple times and still show photoresponsive behavior, something that makes them especially good for use in environmental remediation, and with potential for artificial muscles. Our success in this area, which is the first silicon-derived network polymers to behave this way, has led our group to further investigate improvements to the process, as well as the how's and why's of what is happening within the structure to enable such remarkable response. Funded by NSF-DMR through a LEAPS proposal 9/2021 (see grants), (2 graduate students: Cory Sims, Mehdi Erfani Jazi; 1 undergraduate: Lavano Sands, CSU; 3 papers published, 1 under revision).

02/18-Current Collaboration research project with Ramakrishna Guda (Western Michigan University) on the development of photoactive silsesquioxane copolymers and gaining an understanding of energy/charge transfer taking place through advanced spectroscopic methods. Findings have been published in 3 recent articles. (1 graduate student, Shahrea Mahbub; 1 undergraduate student: Tyler Schrand).

10/18-Current Fundamental research project on the development of new photo-caged silanes for the control of sol gel reactions, substitutions on alkoxy silanes and the development of siloxane 3D printing and sequence defined methods. This project focuses on making new photoalkoxy silanes that are easy to functionalize and then process using light driven sol-gel chemistries. (1 graduate student: Mahmud Rashed, 1 High School Student: Alex Hine). Manuscript in Preparation.

09/19-Current Fundamental research project on the recycling of silicones so that they can be reused in a value neutral or added way. In this project a fluoride driven methodology has been developed to for the depolymerization of silicone elastomers and resins to cyclic siloxanes which can be repolymerized to new silicones, bypassing the need to synthesize new monomers from raw materials. Internally funded by BGSU grant. (1 paper and 2 review articles, 1 graduate student: Herenia Espitia Armenta; 1 undergraduate student: Kristan Major, CSU), 2 papers published, 1 patent submitted

01/20-Current Fundamental research on the development of silicon-sulfur based materials for battery gel electrolytes w/Zayak, A. in BGSU Physics, (1 graduate student, Cory Sims, 1 undergraduate student, Ashley Greene)

03/20-Current Collaboration project with Angelica Vazquez Ortega, Zhaohui Xu, and Christopher Ward (BGSU) investigating the degradation and quantification of

nano/microplastics applied to agricultural fields through biosolids applications. Internally funded by BGSU Building Strength grant 2021-2022. (1 graduate student, Kyle Hallowell)

Future Project

01/22-Future Nitric oxide releasing silicone polymers for reducing infection and thrombosis on medical devices for longer than 30 days at endogenous NO fluxes. Collaboration with Prof. Alexis Ostrowski (BGSU), Prof. Elizabeth Brisbois (UGA), Prof. Hitesh Handa (UGA). (1 graduate student, Kyle Hallowell, 2 undergraduate students Tyler Schrand and Ashley Greene).

Past Projects

06/20-04/22 Industrial Research on High Abbe number cross-linkers for silicone lenses with Johnson and Johnson Vision Care, contract conducted over 2 phases (2 graduate students, Nai-hsuan Hu and Herenia Espitia Armenta).

09/20-12/31/21 Applied Research on Tri-cure coatings for monument preservation with the US National Park Service. These coatings rely on a combination of alkoxysilane, epoxy, and thiol-ene cure chemistries driven by light irradiation. (1 graduate student, Cory Sims) 1 paper submitted, 1 patent submitted.

Post-Doctoral Research Assistant

06/15-07/17 Research group of Professor Timothy Scott, Department of Chemical Engineering, University of Michigan (now Professor at Monash University)
Research involved the synthesis and characterization of monomers and subsequent oligomers for sequenced and dynamic covalently self-assembled polymeric materials through polypeptoid/peptide templating. The synthesis of sulfur containing polymers by thiol-ene reactions for advanced dental restoratives. The synthesis and characterization of iodo-ene perfluoro based materials for radiopaque films.

Graduate Student Research Assistant

01/11-05/15 Research groups of Professors Theodore Goodson III (Chemistry) and Richard M. Laine (Macromolecular Science and Engineering, Materials Science & Engineering) (UM)

Designed and synthesized silsesquioxane (SQ) based materials for electronic and photonic applications. Conducted ultrafast laser spectroscopy (two-photon and fluorescence upconversion) of organic conjugated SQ single molecules and oligomers. Developed experimental and computational methods for making and understanding fluoride catalyzed rearrangements of large cage silsesquioxane based materials. Developed new routes to organic functionalized alkoxysilanes from rice hull ash. Synthesized silsesquioxane based high surface area hydrophobic network polymer gels for insulating materials, and molecular sponges for gas and solvent uptake. Conducted industrially sponsored research for Intel, Boeing and TRW Automotive.

B. Grants:

@ Bowling Green State University (**Funded**):

Title: Fluorophore Synthesis Contract

Role: PI

Funding Agency: Angstrom Technologies, Florence, KY

Funding Amount: ~\$26,000 over 3 months

Dates: Start 07/13/2022 **Funded** (In Progress)

Title: LEAPS-MPS: Photodynamic Hybrid Polymer Network Sponges and their Structure-Property Relationships (SPAR:11126)

Role: PI

Funding Agency: NSF-DMR-POLY (2137672)

Funding Amount: \$247,112 over 2 years, REU Supplement: \$19,845

Dates: Submitted 6/15/21, Start 09/01/2021 **Funded** (In Progress)

Title: Upcycling of Siloxane-based Materials: Depolymerization, Repolymerization, Mechanism, and Direct Reusability

Role: PI, Co-PI Alexis Ostrowski BGSU

Funding Agency: BGSU VP-Research and CPS Pilot Grant

Funding Amount: \$50,000

Dates: Submitted 6/15/21, Start 08/2022 **Funded** (in Progress)

Title: Tri-Cure Hybrid Organo-Silicon Coatings for Monument Preservation (SPAR: 10741)

Role: PI

Funding Agency: US National Park Service (P20AP00319)

Funding Amount: \$20,000 over 12 months

Dates: Start 09/2020, End 12/31/2021 **Funded** (Completed)

Title: Combined Experiential Learning in Chemistry and Lean Manufacturing Courses Through Industrial Consulting Projects

Role: Co-PI w/Brodke, M.

Funding Agency: NSF SEA Change Ventures (1525623)

Funding Amount: \$8,862 over 1 year (Sub Award, PI Van Staaden)

Dates: Submitted 11/2019, **Funded** (Completed)

Title: Silsesquioxane based High Abbe Number Cross-linkers (Phase II) (SPAR:3221014)

Role: PI

Funding Agency: Johnson and Johnson Vision Care Inc.

Funding Amount: \$28,000 over 8 months

Dates: Submission 03/2021, End 04/2022 **Funded** (Completed)

Title: Silsesquioxane based High Abbe Number Cross-linkers (Phase I) (SPAR:3221014)

Role: PI

Funding Agency: Johnson and Johnson Vision Care Inc.

Funding Amount: \$20,300 over 12 months

Dates: Submission 01/2020, End 03/2021 **Funded** (Completed)

Title: Catalytic Transformations of Silicon-based Materials: Raw Materials to Polymer Upcycling (SPAR: 33000344)

Role: PI

Funding Agency: BGSU Building Strength

Funding Amount: \$10,000 over 1 year

Dates: Submitted 11/18/21, Start 02/22 **Funded** (In Progress)

Title: Investigation of Nano/microplastics in Agricultural Fields Applied with Processed Biosolids (SPAR: 33000325)

Role: PI

Funding Agency: Building Strength BGSU

Funding Amount: \$10,000 over 1 year

Dates: Submitted 1/7/21, **Funded** (Completed)

Title: Photocaged Alkoxysilanes for Controlled Siloxane Synthesis (SPAR: 33000319)

Role: PI

Funding Agency: Building Strength BGSU

Funding Amount: \$10,000 over 1 year

Dates: Submitted 10/26/19, **Funded** (Completed)

Title: Silsesquioxane based Photo-dynamic Molecular Sponges for Environmental Remediation and Soft Robotics (SPAR: 33000301)

Role: PI

Funding Agency: Building Strength BGSU

Funding Amount: \$9,827

Dates: Submitted 02/01/19, **Funded** (Completed)

@ Bowling Green State University (**Under Review**):

Title: Polysiloxanol/silicate removal from aqueous wastewater used for siloxane depolymerization from PET surfaces

Role: PI

Funding Agency: Cadel Deinking Company, Spain.

Funding Amount: up to \$60,000 over 1 year

Dates: Submitted 6/28/22, **Under Review**

Title: Long-term and Mediated NO-Release Silicone Polymers for Blood Interface Devices (SPAR: 11383)

Role: PI, Alexis Ostrowski (BGSU), Elizabeth Brisbois (UGA), Hitesh Handa (UGA) (Co-Is)

Funding Agency: NIH-Heart Lung and Blood Institute – R15 (13667429)

Funding Amount: \$433,787 over 3 years

Dates: Submitted 6/27/22, **Under Review**

Title: Modifiable siloxane adhesives having metal and PHA binding capabilities (SPAR:11417)

Role: PI

Funding Agency: PepsiCo Inc.

Funding Amount: \$60,000 over 0.5 years

Dates: Submitted 5/31/22, **Final Stage Review**

@ Bowling Green State University (*In Preparation/Planned*):

Title: Photocaged R-Alkoxysilanes for On-Demand Polymerization Reaction Control

Role: PI

Funding Agency: National Science Foundation – CHEM-MSN

Funding Amount: ~\$500,000 over 3 years

Dates: To be submitted October 2022

Title: Separation and Recycling of Nano and Microplastics from Sewage Sludge

Role: PI

Funding Agency: ACS-PRF

Funding Amount: ~\$100,000 over 2 years

Dates: To be submitted October 2022

Title: Photodynamic Smart Network Hybrid and 3D Printable Polymers

Role: PI

Funding Agency: National Science Foundation – DMR (From LEAPS)

Funding Amount: ~\$400,000 over 3 years

Dates: To be submitted October 2022

@ Bowling Green State University (Submitted (not funded)):

Title: Silicon-based Release Coatings for Molding Applications (SPAR: 11361)

Role: PI

Funding Agency: Sunoco Inc.

Funding Amount: \$100,000 over 0.5 years

Dates: Submitted 3/28/22, **Not Funded**

Title: Keeping Nano/microplastics Out of Lake Erie (SPAR: 11355)

Role: PI, Angelica Vazquez-Ortega and Christopher Ward (Co-PIs)

Funding Agency: Ohio Lake Erie Protection Fund

Funding Amount: \$50,000 over 1 year

Dates: Submitted 04/22/2022, **Not Funded**

Title: Degradation and Generation of Silicon-based Materials for a Greener Future

Role: PI

Funding Agency: 3M Nontenured Faculty Award

Funding Amount: \$45,000 over 3 years

Dates: Submitted 03/22/2022, **Nominated/Not Funded**

Title: Catalytic Transformations of Silicon-based Materials: Raw Materials to Polymer Upcycling (SPAR: 11278)

Role: PI

Funding Agency: DOE Early Career Program (264843)

Funding Amount: \$747,790 over 5 years

Dates: Pre-proposal Approved, Proposal Submitted 01/20/22, **Not Funded**

Title: MRI: Acquisition of a 600 MHz Multi-Nuclear NMR Instrument with Cryoprobe and Solid-State Capabilities

Role: Co-PI w/Forbes (PI), Ostrowski, Sivaguru, Tan

Funding Agency: National Science Foundation (2216113)

Funding Amount: \$781,799

Dates: Submitted 01/19/2022, **Not Funded**

Title: Silicon-based Responsive and Transformable Materials for Societal Advancement (SPAR: 11319)

Role: PI

Funding Agency: Camille and Henry Dreyfus Foundation (Teacher Scholar)

Funding Amount: \$100,000 over 5 years

Dates: Nominated 2/2/22, **Not Funded**

Title: Silsesquioxane/Siloxane Hybrids as Recyclable Vapor Exclusion Layers (SPAR: 11348)

Role: PI

Funding Agency: Sunoco Inc.
Funding Amount: \$100,000 over 0.5 years
Dates: Submitted 3/28/22, **Not Funded**

Title: CAREER: Photocaged R-Alkoxysilanes for On-Demand Functionalization and Polymerization Control (SPAR: 11150)

Role: PI
Funding Agency: NSF-CHEM-MSN (2145043)
Funding Amount: \$620,000 over 5 years
Dates: Submitted 7/26/21, **Not Funded**

Title: The role of wetland organic matter and microorganisms in nutrient filtration in restored and natural wetlands (SPAR: 11109)

Role: PI, Co-PI- Vázquez-Ortega, Ward, McCluney, Midden
Funding Agency: Ohio Sea Grant
Funding Amount: \$160,000 over 2 years
Dates: Submitted 6/3/21, **Not Funded**

Title: Upcycling of Siloxane-based Materials: Depolymerization, Repolymerization, Mechanism, and Direct Reusability (SPAR: 11017)

Role: PI w/Co-PI Ostrowski
Funding Agency: Department of Energy – Polymer Upcycling Program
Funding Amount: \$750,000
Dates: Submitted 03/10/2021, **Full Proposal Not Invited**

Title: Organo-siloxane Photoactivated Coatings (SPAR: 11034)

Role: PI
Funding Agency: Interested Companies through Techconnect Sprints
Funding Amount: \$50,000
Dates: Submitted 03/15/2021, **Not Funded**

Title: MRI: Acquisition of a 600 MHz Multi-Nuclear NMR Instrument with Cryoprobe and Solid-State Capabilities

Role: Co-PI w/Forbes (PI), Ostrowski, Sivaguru, Tan
Funding Agency: National Science Foundation – MRI (2117714)
Funding Amount: \$759,424
Dates: Submitted 01/19/2021, **Not Funded**

Title: Photocaged R-Alkoxysilanes for On-Demand Polymerization Reaction Control (SPAR: 10934)

Role: PI

Funding Agency: National Science Foundation – CHEM-MSN

Funding Amount: \$485,000 over 3 years

Dates: Submitted 11/2020, **Not Funded**

Title: Materials Generation and Degradation Processes for a Green Future

Role: PI

Funding Agency: 3M Corp.

Funding Amount: \$45,000 over 3 years

Dates: Submitted 01/2021, **Nominated, Not Funded**

Title: Photodynamic Sponges Based on Siloxane/Silsesquioxane Network Polymers (SPAR: 10852)

Role: PI

Funding Agency: National Science Foundation - DMR

Funding Amount: \$384,464 over 3 years

Dates: Submitted 11/2020, **Not Funded**

Title: Photoresponsive Alkoxysilanes for Advanced Functionalization and Direct On-demand Polymerization in 3D- Printing (SPAR: 10832)

Role: PI

Funding Agency: Cottrell Scholars (Research Corp.)

Funding Amount: \$100,000 over 3 years

Dates: Submitted 06/2020, **Not Funded**

Title: Hydrophobic and Degradable Moisture Barriers (SPAR: 10954)

Role: PI

Funding Agency: Pepsi Co.

Funding Amount: \$45,000 over 6 months

Dates: Submission 12/2020, **Not Funded**

Title: CAREER: Photodynamic Sponges Based on Photoresponsive Siloxane/Silsesquioxane Network Polymers (SPAR: 10550)

Role: PI

Funding Agency: National Science Foundation – DMR (2042470)

Funding Amount: \$603,000 over 5 years

Dates: Submitted 07/2020, **Not Funded**

Title: Nano/microplastics in Farm Fields Applied with Biosolids (SPAR: 10786)

Role: PI, Co-PI Angelica Vazquez Ortega, Zhaohui Xu

Funding Agency: Ohio Lake Erie Protection Fund

Funding Amount: \$50,000 over 1 year

Dates: Submitted 05/2020, **Not Funded**

Title: Photodynamic Silicon Based Materials for Advanced Industrial Applications

Role: PI

Funding Agency: 3M Corp.

Funding Amount: \$45,000 over 3 years

Dates: Submitted 02/2020, **Nominated, Not Funded**

Title: Photo-caged R-alkoxysilane Pre-cursors for On-demand Reaction Control (SPAR: 10614)

Role: PI

Funding Agency: ACS-Petroleum Research Fund

Funding Amount: \$110,000 over 2 years

Dates: Submitted 10/18/19, **Not Funded**

Title: Photocaged Alkoxysilanes for Controlled Siloxane Synthesis

Role: PI

Funding Agency: BGSU-Thomas Kinstle Professorship

Funding Amount: \$27,000 over 3 years

Dates: Submitted 10/18/19, **Not Funded**

Title: Career: Photodynamic Sponges based on Photo-responsive Siloxane/silsesquioxane Network Polymers (SPAR: 10550)

Role: PI

Funding Agency: National Science Foundation – DMR (1944155)

Funding Amount: \$561,260 over 5 years

Dates: Submitted 07/17/19, **Not Funded**

Title: Silicon-Sulfur (silsesquisulfides) Based Materials from Petrochemical Refining By-Products (SPAR: 10331)

Role: PI

Funding Agency: ACS-Petroleum Research Fund

Funding Amount: \$110,000 over 2 years

Dates: Submitted 11/01/18, **Not Funded**

Title: Photodynamic Silsesquioxane/Siloxane Based Materials

Role: PI

Funding Agency: 3M Corp.

Funding Amount: \$35,000 over 2 years

Dates: Submitted 10/20/18, Nominated, **Not Funded**

Title: Aqueous anion sensing by fluorescent probes integrated into hydrophilic silsesquioxane polymers

Role: Co-PI, w/ PI Anzenbacher

Funding Agency: NSF-CHEM-MSN (1905023)

Funding Amount: \$536,396 over 3 years

Dates: Submitted 10/20/18, **Not Funded**

Title: Silsesquioxane based Photo-dynamic Molecular Sponges for Environmental Remediation and Soft Robotics

Role: PI

Funding Agency: Building Strength BGSU

Funding Amount: \$9,827

Dates: Submitted 10/29/18, **Not Funded**

Title: Center for Light Responsive Coatings and Materials

Role: Co-investigator, PI Forbes

Funding Agency: NSF-CCI (1851098)

Funding Amount: \$N/A for 5 years

Dates: Submitted 09/01/18, **Not Funded**

Title: Silsesquioxane based Near-IR Photosensing Materials

Role: PI

Funding Agency: Semiconductor Research Corp. (W32293)

Funding Amount: \$278,087 for 2 years

Dates: Submitted 08/01/18, **Not Funded**

Title: Silsesquioxane based Near-IR Absorbing Visible Transparent Materials (SPAR: 10225)

Role: PI

Funding Agency: Samsung Electronics Corp.

Funding Amount: \$186,581 per year

Dates: Submitted 07/01/18, **Not Funded**

Title: Photodynamic Molecular Sponges for Fluid Hydraulic Actuated Motion (SPAR: 10084)

Role: PI

Funding Agency: DARPA

Funding Amount: \$842,641 for 3 years

Dates: Submitted 12/04/17, **Not Funded**

X. Publications or Equivalencies

A. Publications

1. Books

- Book Chapters

2. Furgal, J. C.; Lenora, C. U. "Green Routes to Silicon Based Materials and Their Environmental Implications," *In Green Chemistry in Government and Industry, part of Green Chemical Processing*; Benvenuto, M. A., Plaumann, H. Eds.; De Gruyter, 2020. *Book Chapter*, ISBN: 978-3-11-059728-8.

1. Furgal, J. C.; Dunn, M.; Wei, T.; Scott, T. F. "Emerging Applications of Dynamic Covalent Chemistry in Nanotechnology." *Dynamic Covalent Chemistry (DCC): Principles, Reactions, and Applications*, Ed. Zheng, W. December 2017. ISBN: 978-1-119-07563-9.

2. Journal Articles

- Peer Reviewed

33. Furgal, J. C.;* Brodke, M. R. H. . Combined Experiential Learning in Chemistry and Lean Manufacturing Courses Through Industrial Consulting Projects, **2022**, *Preparation*

32. Rashed, M. R.; Sims, C. B.; Mahbub, S.; Hu, N., Greene, A. N.; Furgal, J. C.* Revitalizing Photo-activated R-Alkoxysilanes Containing 2-Nitrobenzyl Protecting Groups as Stable Precursors for Photo-driven Polymerizations, **2022**, *Preparation*

31. Sims, C. B.; Lenora, C. U. Furgal, J. C.* Hybrid Tri-cure Organo-Silicon Coating System for Monument Preservation, *Coatings*, **2022**, *12*, 1098.

<https://doi.org/10.3390/coatings12081098>.

30. Hu, N.; Sims, C. B.; Schrand, T. V.; Haver, K. M.; Espitia Armenta, H.; Furgal, J. C.* Formation of Nanostructured Silicas through the Fluoride Catalysed Self

Polymerization of Q-type Silica Cages, *Chem Commun.*, **2022**, ASAP.

<https://doi.org/10.1039/D2CC02672D>

29. Rupasinghe, B.; Furgal, J. C.* Degradation of Silicone-based Materials as a Driving Force for Recyclability. *Polym. Int.* **2022**, *71*, 521-531. <https://doi.org/10.1002/pi.6340>.

28. Mahbub, S.; Saha, S.; Guda, R.; Furgal, J. C.* Beads on a Chain (BoC) Fluorescent Oligomeric Materials: Inter Interactions of Conjugated Organic Cross-Linkers with Silsesquioxane Cages. *J. Phys. Chem. B*, **2021**, *125*, 11457-11472, <https://doi.org/10.1021/acs.jpcc.1c05282>

27. Mahbub, S.; Furgal, J.C.* Synthesis and Steady State Photophysical Property Analysis of Beads on a Chain (BoC) Silsesquioxane Oligomers Containing Phenyl and Heterocyclic Cross-linkers. *Silicon*, **2021**, *13*, 4223-4235 (Special Issue).

26. Rupasinghe, B.; Furgal, J. C.* Full Circle Recycling of Polysiloxanes via Room Temperature Fluoride Catalyzed Depolymerization to Repolymerizable Cyclics. *ACS Appl. Polym. Mater.* **2021**, *3* (4), 1828–1839. <https://doi.org/10.1021/acsapm.0c01406>.

25. Guan, J.; Sun, Z.; Ansari, R.; Liu, Y.; Endo, A.; Unno, M.; Ouali, A.; Mahbub, S.; Furgal, J. C.; Yodsins, N.; et al. Conjugated Copolymers That Shouldn't Be. *Angew. Chemie Int. Ed.* **2021**, *60* (20), 11115–11119. <https://doi.org/10.1002/anie.202014932>.

24. Hu, N.; Furgal, J. C.* Photoreversible Loading and Unloading of Q–Silsesquioxane Dynamic Network Sponges. *Adv. Funct. Mater.* **2021**, 202010114, <https://doi.org/10.1002/adfm.202010114>.

23. Lenora, C. U.; Hu, N.; Furgal, J. C.* Thermally Stable Fluorogenic Zn(II) Sensor Based on a Bis(Benzimidazole)Pyridine-Linked Phenyl-Silsesquioxane Polymer. *ACS Omega* **2020**, *5* (51), 33017–33027. <https://doi.org/10.1021/acsomega.0c04366>.

22. Guan, J.; Arias, J. J. R.; Tomobe, K.; Ansari, R.; Marques, M. de F. V.; Rebane, A.; Mahbub, S.; Furgal, J. C.; Yodsins, N.; Jungsuttiwong, S.; et al. Unconventional Conjugation via vinylMeSi(O–)2 Siloxane Bridges May Imbue Semiconducting Properties in [vinyl(Me)SiO(PhSiO1.5)8OSi(Me)vinyl-Ar] Double-Decker Copolymers *ACS Appl. Polym. Mater.* **2020**, *2*, 3894. <https://doi.org/10.1021/acsapm.0c00591>

21. Hu, N.; Furgal, J. C.* R-Silsesquioxane-Based Network Polymers by Fluoride Catalyzed Synthesis: An Investigation of Cross-Linker Structure and Its Influence on Porosity *Materials* **2020**, *13* (Invited Special Issue on Silsesquioxanes), 1849. <https://dx.doi.org/10.3390/ma13081849>

20. Hu, N.; May, T. A.; Lenora, C. U.; Hershberger, N. C.; Furgal, J. C.* In situ formed methyl-co-(bis-R) silsesquioxane based polymer networks with solvent controlled pore size distributions and high surface areas *Materials Chemistry Frontiers* **2020**, *4* (Selected as "Hot Paper"), 851. <http://dx.doi.org/10.1039/C9QM00748B>

19. Furgal, J. C.; Leguizemon, S.; van Dijke, J.; Scott, T. F. “Beta-Peptoid Building Blocks for Next Generation Sequence Defined Polymers” *European Polymer Journal*, **2019**, *118*, 306-311, DOI: 10.1016/j.eurpolymj.2019.06.008.

18. Furgal, J. C.* “Polymers Course for Small Colleges and Universities” *Journal of College Science Teaching*. **2018**, *48* (1), 30–35.

17. Furgal, J. C.*; Yamane, H.; Odykirk, T. R.; Chujo, Y.; Laine, R. M. “High Surface Area Silsesquioxane Polymer Gels Made by Fluoride Catalyzed Rearrangement,” *Chem. Eur. J.* **2017** *24* (1), 274–280, DOI: 10.1002/chem.201704941.

BEFORE FACULTY APPOINTMENT

16. Wei, T.; Furgal, J. C.; Scott, T. F. "In Situ Deprotection and Dynamic Covalent Assembly Using a Dual Role Catalyst", *Chem. Comm.*, **2017**, *53*, 3874-3877, DOI: 10.1039/C7CC01028A.
15. Zavada, S.; Furgal, J. C.; Wood, N.; Scott, T. F. "Oxygen-mediated Polymerization Initiated by Oltipraz-derived Thiones," *Journal of Polymer Science Part A*, **2017**, *55*, 1373-1382, DOI: 10.1002/pola.2850.
14. Wei, T.; Furgal, J. C.; Jung, J-H.; Scott, T. F. "Registry Mechanism of Dynamic Covalent Molecular Ladders", *Polymer Chemistry*, **2017**, *8*, 520-527, *Featured as Issue Cover*. DOI: 10.1039/C6PY01951.
13. Furgal, J. C.; Laine, R. M. "Nucleophilic Attack of Phenyllithium at Tetrahedral Silicon in Alkoxysilanes. An Alternate Mechanism," *Bull. Chem. Soc. Japan*. **2016**, *89*, 705-725, DOI: 10.1246/bcsj.20160039.
12. Furgal, J. C.; Goodson III, T.; Laine, R. M. "D_{5h} [PhSiO_{1.5}]₁₀ Synthesis via F⁻ Catalyzed Rearrangement of [PhSiO_{1.5}]_n. An Experimental/Computational Analysis of Likely Reaction Pathways," *Dalton Trans.* **2016**, *45*, 1025-1039, DOI: 10.1039/c5dt04182a.
11. Laine, R. M.; Furgal, J. C.; Doan, P. H.; Pan, D. Popova, V. "Escaping Carbothermal Reduction: Distilling Silica from Biogenic Silica Sources," *Angew. Chem. Int. Ed.* **2016**, *55*, 1065-1069, DOI: 10.1002/anie.201506838.
10. Scott, T. S.; Furgal, J. C.; Kloxin, C. "Expanding the Alternating Propagation-Chain Transfer (APT)-based Polymerization Toolkit: The Iodo-Ene Reaction," *ACS Macro Lett.* **2015**, *4*, 1404-1409, DOI: 10.1021/acsmacrolett.5b00640
9. Pan, D.; Yi, E.; Doan, P. H.; Furgal, J. C.; Schwartz, M.; Clark, S.; Goodson Iii, T.; Laine, R. M. Microporous Inorganic/organic Hybrids via Oxysilylation of a Cubic Symmetry Nanobuilding Block [(HMe₂SiOSiO_{1.5})₈] with R_xSi(OEt)_{4-x}. *J. Ceram. Soc. Japan* **2015**, *123*, 756-763.
8. Bahrami, M.; Furgal, J. C.; Hashemi, H.; Ehsani, M.; Jahani, Y.; Goodson III, T.; Kieffer, J.; Laine, R. M. "Synthesis and characterization of nano-building blocks [o-RStilbeneSiO_{1.5}]_{10,12} (R = Me-, MeO-, NBoc- and CN. Unexpected photophysical properties arising from apparent asymmetric cage functionalization as supported by modeling studies," *J. Phys. Chem. C*. **2015**, *119*, 15846-15858, DOI: 10.1021/acs.jpcc.5b02678.
7. Dougherty, C.; Furgal, J. C.; van Dongen-Sohmer, M.; Goodson III, T.; Manono, J; DiMaggio, S.; Banaszak-Holl, M. "Systematically Controlled, Precisely Defined Dendrimer-Dye Conjugates" *Chem. Eur. J.*, **2014**, *20*, 4638 - 4645, DOI: 10.1002/chem.201304854.
6. Yi, E.; Furgal, J. C.; Azurdia, J.; Laine, R.M. "Roll Your Own - Nano-Nanocomposite Capacitors." *J. Mat. Chem.*, **2014**, *2*, 3766-3775, DOI: 10.1039/C3TA14976E.
5. Jung, J. H.; Chou, K.; Furgal, J. C.; "Synthesis of acetoxypheyl- and hydroxypheyl-terminated polyfunctional T₈, T₁₀, T₁₂ silsesquioxanes and initial studies on their use in the formation of highly crosslinked polyesters," *Appl. Organometal. Chem.* **2013**, *27*, 666-672, DOI: 10.1002/aoc.3054.
4. Jung, J. H.; Furgal, J. C.; Clark, S. C.; Schwartz, M. C.; Chou, K.; Laine, R. M. "Copolymerization of [p-IPhSiO_{1.5}]₈, I₈OPS] with Divinyl (DVB)- and Diethynylbenzene (DEB) gives Beads on a Chain (BoC) Polymers with Functionalized Beads. The DEB

Systems Exhibit through Chain, Extended 3-D Conjugation in the Excited State.” *Macromolecules*, **2013**, *46*, 7580-7590, DOI: 10.1021/ma401422t.

3. Furgal, J.C.; Jung, J.H.; Clark, S.C.; Goodson III, T.; Laine, R.M. “Beads on a Chain (BoC), Phenylsilsesquioxane (SQ), Conjugated Polymers Via F⁻ Catalyzed Rearrangements and ADMET and Reverse Heck Cross-coupling Reactions; through chain, extended conjugation in 3-D,” *Macromolecules* **2013**, *46*, 7591-7604, DOI: 10.1021/ma401423f.

2. Furgal, J.C.; Jung, J.H.; Goodson, T.; Laine, R.M. “Analyzing Structure-Photophysical Property Relationships of Isolated T₈, T₁₀, and T₁₂ Stilbenevinyl Silsesquioxanes,” *J. Am. Chem. Soc.*, **2013**, *135*, 12259-12269, DOI: 10.1021/ja4043092.

1. Jung, J.H.; Furgal, J.C.; Goodson, III, T.; Mizumo, T.; Schwartz, M.; Chou, K.; Vonet, J.F.; Laine, R.M.; “3-D Molecular Mixtures of Catalytically Functionalized [vinylSiO_{1.5}]₁₀/[vinylSiO_{1.5}]₁₂. Photophysical Characterization of Second Generation Derivatives,” *Chem. Mater.* **2012**, *24* (10), 1883–1895, DOI: 10.1021/cm300587s.

B. Equivalencies

- Patents and Patent Applications

4. Patent filed: Furgal, J. C.; Sims, C. B. Tri-cure Hybrid Organosilicon Coatings, **2022**, Provisional: USPTO **63/356,197**.

3. Patent Disclosure: Furgal, J. C.; Rashed, M. Direct Write Iterative Printing of Silicon-Oxygen Bonds, **2021**, Patent recommended for filing by BGSU, IDN213.

2. Furgal, J. C.; Rupasinghe, B. Fluoride Catalyzed Polysiloxane Depolymerization, **2022**, US Patent Application (non-Provisional): **PCT/US22/14500**.

1. Laine, R. M.; Furgal, J. C.; Popova, V.; Yi, E. “Synthesis of Alkoxysilanes directly/indirectly from high surface area silica sources without first producing silicon metal and their use for making fumed silica.” *Patent 2017 US2016/0304540 A1*.

- Editorials

1. Hartmann-Thompson, C.; Furgal, J. C. This Special Issue Section of Silicon Showcases the Work of Some of the Presenters at the American Chemical Society POLY Division Symposium ‘Silicon-Based Hybrid Materials: Today, Tomorrow and the Future’ That Took Place at the First Ever Virtual ACS National Meeting (August 2020). *Silicon* **2021**. <https://doi.org/10.1007/s12633-021-01038-y>.

- Work Disseminated to the Public Online or in the News

11/10-Present	Writing and design of the Silsesquioxanes Wiki page
03/11	Writing and design of page on Plasma Polymerization
02/20	Troxel, M. Toledo Blade Article, “BGSU students solve problems for local companies” https://tinyurl.com/y636p59e
12/20	Carle, J. Sentinel-Tribune, “‘Monumental’ Research” https://tinyurl.com/y3dpgjqu
02/22	Witt, D. 13 ABC News, Toledo, OH “BGSU researchers develop “smart sponge” to remove toxins” https://tinyurl.com/5n8dh5v7
04/22	BGSU Science Café “Silicon as a building block for influencing positive environmental transformation” https://tinyurl.com/mr3vnafc

XI. Presentations and Papers Read

A. Invited Conference Presentations

13. Furgal, J. C. Photoresponsive silicon-based smart sponges toward environmental remediation applications. *Photochemistry Spotlight: Answering the Big Questions in Photochemistry, Division of Physical Chemistry, American Chemical Society National Meeting*, Chicago, IL, August 2022, (3734875), Invited Presentation.
12. Furgal, J. C. Silicon-Based Hybrid Polymers from Photochemical Responses to Catalytic Recycling. *Ohio Photochemical Society Meeting*, July 2022, Bowling Green, OH, Invited Presentation.
11. Furgal, J. C. Silicon-Based Hybrid Polymers from Photochemical Responses to Catalytic Recycling. *Silicon Containing Polymers and Composites Workshop*, December 2021, San Diego, CA, Invited Presentation, Workshop Organizer.
10. Furgal, J. C. Hybrid Photodynamic Sponges and the Catalytic Depolymerization of Silicone Resins, *Saturday Covid Seminar Series on Light*, February 2021, Online, Invited Presentation.
9. Furgal, J. C.; Hu, N. Silsesquioxane Hybrid Polymers from Static to Photoactive Sponges, 4th International Symposium on Silsesquioxane Functional Materials, (Korea), Remote, November 2020. Invited Presentation.
8. Furgal, J. C. Experimental and Computational Investigation of the Photophysical Properties of Phenylsiloxanes/silsesquioxanes. *ACS National Meeting Fall 2020 - Silicon Based Hybrid Materials for Today, Tomorrow and the Future*, 2020. Invited Presentation, Symposium Organizer.
7. Furgal, J. C. Silsesquioxane Hybrids from Static to PhotoActive Materials. *Inter-American Photochemical Society Meeting*, 2020. Invited Presentation
6. Furgal, J. C. Photochemical/Physical Interactions in Organosilicon Based Materials. *Great Lakes Regional Meeting of the American Chemical Society*, May 2019, Lisle, IL, Invited Presentation.
5. Furgal, J. C.; Hu, N.; Ruppasinghe, B.; May, T. A. High Surface Area Silsesquioxane Hybrids from Static to Photo-active Materials. *Silicon Containing Polymers and Composites*, December 2018. San Diego, CA, Invited Oral Presentation.
4. Furgal, J. C. High Surface Area Silsesquioxane Hybrids from Static to Active Materials. *Ohio Photochemical Society Meeting*, May 2018, Oregon, OH, Invited Oral Presentation.
3. Furgal, J. C. "Structure-photophysical property relationships of stilbenevinyl silsesquioxanes (SQs) and their oligomeric analogs in solution and solid state," Ohio Photochemical Society Meeting, May 2017, oral invited presentation.
2. Furgal, J. C.; Laine, R. M. "Nucleophilic attack of organolithium at tetrahedral silicon in alkoxysilanes: an alternate pathway," *Silicon Containing Polymers and Composites Workshop*, ACS Polymer Division, San Diego, CA, December 14-17, 2014; American Chemical Society: Washington, DC; (Invited, Oral).
1. Furgal, J. C.; Jung, J. H.; Mizumo, T.; Schwartz, M.; Chou, K.; Goodson III, T.; Laine, R. M. "Chemistry and photophysical properties of conjugated organic functionalized T_{10/12} silsesquioxanes," *Excellence in Graduate Polymer Research (Presidential Event)*, 243rd

National Meeting of the American Chemical Society, San Diego, CA, March 25-29, 2012; American Chemical Society: Washington, DC; POLY 63. Received Monetary Award and Certificate (Nominated, Oral).

B. Contributed Conference Presentations

26. Furgal, J. C.;* Nu, N.; Rashed, M. R.; Greene, A. M. Photoresponsive Silicon-based Smart Sponges Toward Environmental Remediation Applications, *ACS Central Regional Meeting*, Ypsilanti, MI, June 7-10, 2022, Oral Presentation. (3734898).
25. Furgal, J. C.;* Brodke, M. R. H. Combined Experiential Learning in Chemistry and Lean Manufacturing Courses Through Industrial Consulting Projects, *ACS Central Regional Meeting*, Ypsilanti, MI, June 7-10, 2022, Oral Presentation. (3734901).
24. Furgal, J. C. Photoresponsive Silicon-based Materials: Substance Uptake/Release and Bond Forming Reactions, *51st Silicon Symposium*, San Diego, CA, March 18-20, 2022, Oral Presentation.
23. Furgal, J. C. Network silsesquioxane-based photo-dynamic sponges for reversible analyte uptake and release (3426582). *Pacificchem: Silicon-Containing Polymers and Oligomers: Synthesis, Structural Control, Function, Hybridization, and Applications* (#289), 2021, Virtual.
22. Furgal, J. C. Q-cage Silsesquioxane Networks as Photoresponsive Sponges for Substance Uptake and Release and Processes in Silicone Recycling. *International Conference on Interdisciplinary Approaches in Science (Sri Lanka)*, Nov 2021, Virtual.
21. Furgal, J. C.;* Rupasinghe, B. Full Circle Recycling of Silicones and their Resins. *Materials Research Society Meeting*, Spring 2021. Virtual, Oral presentation (3561859)
20. Furgal, J. C. Silsesquioxane Hybrids from Static to PhotoActive Materials. *American Chemical Society National Meeting*, Spring 2021. Virtual, Oral presentation (3537567)
19. Furgal, J. C. Silsesquioxane Hybrids from Static to PhotoActive Materials. *Next Generation Smart Materials*, November 2019. Attendee, Oral presentation
18. Furgal, J. C.;* Hu, N.; May, T. A. Light-switchable silicon-based polymers with high thermal stability and surface areas. *Inter-American Photochemical Society Meeting*, 2019. January 2-5, 2019, Sarasota, Florida, Poster Presentation.
17. Furgal, J. C. Polymers Course for Small Colleges and Universities. *2nd Annual Detroit Polymer Symposium*, December 2018, Detroit, MI, Poster Presentation
16. Furgal, J. C. Nanoporous Photo-responsive Silsesquioxane based Network Copolymers made by TBAF Catalysis. *American Chemical Society National Meeting*, August 2018, Boston, MA, Oral Presentation.
15. Furgal, J. C. High Surface Area Silsesquioxane Hybrids from Static to Active Materials. *IUPAC Photochemistry Conference*, July 2018, Dublin, Ireland, Poster Presentation.
14. Furgal, J. C. Polymers Course for Small Colleges and Universities. *American Chemical Society National Meeting*, March 2018, New Orleans, LA, Poster Presentation
13. Furgal, J. C. High Surface Area Silsesquioxane Hybrids from Static to Active Materials. *Glass City Chemistry Conference*, June 2018, Oral Presentation.
12. Furgal, J. C. "High Surface Area Silsesquioxane Hybrids from Static to Active Materials" IAPS 2018, January 2-5, 2018, Sarasota, Florida, Poster Presentation.
11. Furgal, J. C.; Wei, T.; Scott, T. F. "Sequence Defined "Zipping" of Molecular Ladders based on β -peptoids," *Sequence Controlled Polymers*, 252nd National Meeting of the

American Chemical Society, Philadelphia, PA, August 21-25, 2016; American Chemical Society: Washington, DC; POLY 572. (Poster).

10. Furgal, J. C.; Yamane, H.; Odykirk, T. R.; Chujo, Y.; Laine, R. M. "High Surface Area Silsesquioxane Polymer Gels Made by Fluoride Catalyzed Rearrangement," *Polychar-23*, University of Nebraska, Lincoln, NE, May 13, 2015 (Poster).

9. Furgal, J. C.; Laine, R. M. "Nucleophilic attack of organolithium at tetrahedral silicon in alkoxy silanes: an alternate mechanism," *Waseda University – University of Michigan Joint Symposium*, Ann Arbor, MI, March 20, 2015 (Oral).

8. Furgal, J. C.; Goodson III, T.; Laine, R. M. "The Chemistry of 3D Conjugated Organic Functionalized T_{10/12} Silsesquioxane Cages (SQs) for Optical and Electronic Applications," *Poster Session*, PINO Conference, Case Western Reserve University, Cleveland, OH, June 20, 2014 (Poster).

7. Furgal, J. C.; Iijima, Y.; Goodson III, T.; Laine, R. M. "Synthesis and properties of D5h symmetric phenyl and vinyl silsesquioxanes," *New Synthesis and Characterization of Polymers*, 247th National Meeting of the American Chemical Society, Dallas, TX, March 16-20, 2014; American Chemical Society: Washington, DC; POLY 572. (Oral).

6. Furgal, J. C.; Jung, J. H.; Goodson III, T.; Laine, R. M. "Structure-photophysical property relationships of stilbenevinyl silsesquioxanes (SQs) and their oligomeric analogs in solution and solid state," 44th Central Regional Meeting of the American Chemical Society, Mt. Pleasant, MI, May 15-17, 2013; American Chemical Society: Washington, DC; (Poster).

5. Furgal, J. C.; Schwartz, M.; Clark, S.; Chou, K.; Jung, J.H.; Yi, E.; Laine, R. M. "Nanoporous silsesquioxane-siloxane based network copolymers and gels through B(C₆F₅)₃ catalysis," *Joint Polymer and Polymeric Materials Science and Engineering Poster Session*, 245th National Meeting of the American Chemical Society, New Orleans, LA, April 7-11, 2013; American Chemical Society: Washington, DC; PMSE 354. (Poster).

4. Furgal, J. C.; Abeyasinge, N.; Jung, J. H.; Yi, E.; Laine, R. M.; Goodson III, T. "Analyzing Structure-Photophysical Property Relationships of T₈, T₁₀, T₁₂ and Oligomeric Stilbenevinyl Silsesquioxanes," *Hybrid Materials: POSS and Silane Coupling Agents*, 245th National Meeting of the American Chemical Society, New Orleans, LA, April 7-11, 2013; American Chemical Society: Washington, DC; POLY 147. (Oral).

3. Furgal, J. C.; Jung, J. H.; Goodson III, T.; Laine, R. M. "The Chemistry of 3D Conjugated Organic Functionalized T_{10/12} Silsesquioxane Cages (SQs) for Optical and Electronic Applications," *Chemical Aspects of Alternate Energy*, 43rd Central Regional Meeting of the American Chemical Society, Dearborn, MI, June 5-9, 2012; American Chemical Society: Washington, DC; 119 (Oral).

2. Furgal, J. C.; Jung, J. H.; Clark, S. C.; Zhou, J.; Goodson III, T.; Laine, R. M. "The Chemistry of 3D Conjugated Organic Functionalized T_{10/12} Silsesquioxane Cages (SQs) for Optical and Electronic Applications," *Poster Session*, 10th National Graduate Research Polymer Conference, Case Western Reserve University, Cleveland, OH, May 23-24, 2012 (Poster).

1. Cullen, L. R.; Furgal, J. C.; Gianino, J. B.; Hamlin, A. M.; Lezotte, J. W.; Mio, M. J. "One-pot, unsymmetric Cadiot-Chodkiewicz reaction utilizing an in situ ethynylsilane deprotection," *Abstract of Papers*, 237th National Meeting of the American Chemical Society, Salt Lake City, UT, March 22-26, 2009; American Chemical Society: Washington, DC; ORGN 0583 (Poster).

C. Invited Research Seminar Presentations

11. Furgal, J. C.; Rupasinghe, B.; Sims, C. B. Silicon as a Building Block for Influencing Positive Environmental Transformation, BGSU Science Café 2022
10. Furgal, J. C. Q-cage/Silsesquioxane Networks as Photoresponsive Sponges for Substance Uptake and Release. Wayne State University Invited Seminar, March 2022.
9. Furgal, J. C. Q-cage/Silsesquioxane Networks as Photoresponsive Sponges for Substance Uptake and Release. Marquette University Invited Seminar, March 2022.
8. Furgal, J. C. Q-cage/Silsesquioxane Networks as Photoresponsive Sponges for Substance Uptake and Release. University of Illinois Chicago Invited Seminar, March 2022.
7. Furgal, J. C. Q-cage/Silsesquioxane Networks as Photoresponsive Sponges for Substance Uptake and Release. University of South Carolina Invited Seminar, October 2021.
6. Furgal, J. C. Q-cage/Silsesquioxane Networks as Photoresponsive Sponges for Substance Uptake and Release. University of Toledo Invited Seminar, October 2021.
5. Furgal, J. C. Q-cage/Silsesquioxane Networks as Photoresponsive Sponges for Substance Uptake and Release. University of Georgia Chemical Engineering Seminar, October 2021.
4. Furgal, J. C. Silsesquioxane Hybrids from Static to PhotoActive Materials. Youngstown State University Seminar, November 2019. Invited Presentation
3. Furgal, J. C. Solvent Controlled Porosity in Silsesquioxane based Network Polymers and their Structure-Property Relationships. *Shandong University, Jinan City, Shandong Province, China*, planned December 2019, *Invited Seminar still pending due to COVID.*
2. Furgal, J. C.; Hu, N.; Rupasinghe, B.; May, T. A. High Surface Area Silsesquioxane Hybrids from Static to Active Materials. *Lewis University Seminar*, November 2018. Romeoville, IL, Invited Seminar.
1. Furgal, J. C. “High Surface Area Silsesquioxane Hybrids from Static to Active Materials” *Western Michigan University*, Nov 6, 2017, Kalamazoo, MI, Invited Seminar.

XII. Service

A. Department

2017-2020	Chair Graduate Recruitment Committee
2017-2020	Chair Graduate Admissions Committee
2018	Biochemistry Faculty Search Committee
2019-Present	Director Mass Spectrometry Lab Maintenance and Management
2021-Present	Member PCS Infrastructure Committee

B. College

2018-Present	Department Chair Search Committee (Chemistry)
2018-Present	Graduate Faculty Representative for Three Student Committees

C. University

2018-Present	Member of University Laboratory Safety Committee
2018-Present	Alternate for PSLB Comprehensive Emergency Action Response
2020-2021	SPAR (Sponsored Projects Office) Improvement Panel Member

D. Professional

2011-Present Reviewer for Journal of Physical Chemistry
2018-Present Reviewer for Ohio Academy of Sciences
2011-2015 Reviewer for Applied Organometallic Chemistry
2019-Present Reviewer for Green Chemistry
2019-Present Reviewer for 6 NSF, 2 ACS-PRF, 3 DOE proposals
2020-Present Editorial Board Member for MDPI Materials
2020-Present Reviewer for MDPI Materials
2020-Present Reviewer for MDPI Polymers
2020-Present Reviewer for Soft Matter
2020-Present Reviewer for Polyhedron
2020-Present Reviewer for Silicon
2021-Present Reviewer for Macromolecules
2021-Present Reviewer for Physical Chemistry Chemical Physics
2021-Present Reviewer for RSC Advances
2021-Present Reviewer for Industrial and Engineering Chemistry Research
2021-Present Reviewer for Chemical Communications
2022-Present Reviewer for Organometallics
2022-Present Reviewer for Chemical Science
2022-Present Reviewer for MDPI Journal of Marine Science and Engineering

2020- ACS National Meeting Fall 2020 Silicon Based Hybrid Materials for Today, Tomorrow and the Future, San Francisco, CA (Online), Primary Chair and organizer of symposium at ACS National Meeting Fall 2020 bringing together 30 silicon science researchers from around the world to present their research. Also participated in the national meeting. (Aug 16-19 2020, Online).

2021- Organizing Committee Chair for Silicon Containing Polymers and Composites Workshop which took place in December 2021 in San Diego, CA, American Chemical Society Polymer Division [Scope: International] Workshop dedicated to learning new and interesting techniques and connecting researchers in the field of silicon polymers.

E. Community

2021-22 Plastics workshop for a diverse group of high school students at Fitzgerald High School in Warren, MI to teach the importance of plastics reuse and recycling, as well as teaching them advanced polymer techniques we are working on in our lab.
2018-21 Community Based Learning outreach program in conjunction with Chem 4660/5660 Organic Spectroscopy and Lean Manufacturing courses with Michelle Brodke at Firelands, where students work with outside companies including: Master Fluid Solutions, Spectra-photopolymer, PBE, Crescent, Ventra, and Fruedenburg NOK to help them solve real world chemical problems facing their businesses and to aid growth in NW Ohio
2018-22 High School Student Lab Research, PICNICS Program, BGSU

- 2020 NW Ohio Regional Science Olympiad Density Middle School Event - Supervisor
 2019 Featured panelist University of Detroit Mercy “So you want to go to grad school”, University of Detroit Mercy
 2019 NW Ohio Regional Science Olympiad Density Middle School Event - Supervisor
 2018 Featured panelist University of Michigan, Chemistry Dept. “Academic Panel at the Aluminum Career Event as part of the Karle Graduate Symposium”
 University of Michigan
 2018 Materials Science Event Design and Supervision, Science Olympiad
 2018-20 Ohio Junior Science Poster Judge, Ohio Junior Science and Humanities Symposium, BGSU
 2018 CURS Program Annual Poster Session Judge, BGSU
 2018 Chemistry Department Undergraduate Student Summer Research Fellowship Reviewer
 2018 Graduate Student Excellence Award Judge, BGSU
 2017&18 Featured panelist University of Detroit Mercy “So you want to go to grad school”, University of Detroit Mercy
 2016-17 miLEAD Non-Profit Consulting & Executive Board Webmaster
 2016-17 Southeast Michigan Science Fair Judge
 2013 Rackham Graduate School Clean-up Detroit with Focus-Hope
 2007-10, 15 Girl Scouts Chemistry Day (Chemistry Merit Badge)
 2007-10 Detroit Area Pre-College Engineering Program for Chemistry and Physics (DAPCEP)

XIII. Research or Professional Consultantships:

- 2019-2020 Chemical Consultant for Satelytics, Inc. Toledo, OH
 2020-2021 Consultant for Crescent Man. on Coating Formulations, Fremont, OH
 2019-Current Coatings and processes consultant for Mavinated Inc, Duval, FL

XIV. Membership in Professional Organizations

- 2007-Present American Chemical Society (ACS)
 POLY, PMSE, and ED. divisions
 2017-Present Inter-American Photochemical Society (IAPS)
 2018-Present Materials Research Society (MRS)
 2018-2020 National Science Teachers Association (NSTA)

XV. Honors and Awards

A. Membership in Honor Societies

Phi Kappa Phi Graduate Honor Society
 Pi Mu Epsilon Mathematics Honor Society
 Alpha Sigma Nu Jesuit Honor Society

B. Awards (List award, date, sponsor, etc.)

2022	Outstanding Early Career Research Award (BGSU, VPREE)
2021	Launching Early-Career Academic Pathways-MPS-NSF (first cohort, NSF)
2020	Public Impact Award for Community Based Learning (BGSU)
2019	Teaching Excellence Certificate (BGSU)
2017	College of Engineering and Science All Star Alumni Award (UDM)
2015	PolyChar Conference Travel Fellowship (U-Nebraska)
2014	Macromolecular Science and Engineering Symposium Best Overall Poster (UM)
2014	Rackham Predoctoral Fellowship for Outstanding Graduate Students (UM)
2014	Chemistry Research Excellence Fellowship (UM)
2013	Vaughan Symposium Student Presentation Award (UM)
2012	Excellence in Graduate Polymer Research Symposium Oral Presentation Award (ACS Polymer Division)
2012	Vaughan Symposium Dow Foundation Travel Award (UM/Dow Foundation)
2010	American Chemical Society Award (UDM/Detroit ACS)
2010	Linsenmeyer Award for College Service (UDM)
2010	Chemistry & Biochemistry Department Service Award (UDM)
2010	Henkel Scholarship (UDM)
2009	University of Illinois Organic Chemistry Summer Research Snyder Fellowship
2009-10	College of Engineering and Science Key Award Plaque (UDM)
2008-09	Vitti Scholarship (UDM)
2006-10	College of Engineering and Science Dean's List (UDM)
2006-10	Insignis Scholarship (UDM)
2006	American Polish Cultural Society Scholarship (UDM)

UDM = University of Detroit Mercy, UM = University of Michigan Ann Arbor)

Biography

Joseph C. Furgal received his B.S. in Chemistry from the University of Detroit Mercy, while conducting undergraduate research with M. Mio and a Snyder summer research fellowship at the University of Illinois Urbana-Champaign under the direction of J. Moore. He earned his PhD. in Materials Chemistry under the direction of Professors R. M. Laine and T. Goodson III on silsesquioxane based materials for energy/photonics applications at the University of Michigan Ann Arbor. He then went on to a postdoctoral research position in Chemical Engineering at the University of Michigan under the direction of T. F. Scott, looking at sequence defined peptoid oligomers and their self-assembly. Joseph is currently an Assistant Professor in the Department of Chemistry and Center for Photochemical Sciences at Bowling Green State University in Bowling Green, Ohio. His current work focuses on using hybrid (silsesquioxane and siloxane) based materials for the development and fundamental chemical understanding of photo-active architectures in the areas of switches, triggers, separations, sensors, self-healing and environmental remediation. This research is currently funded by the NSF, National Park Service, and Johnson and Johnson Vision Care Inc.

<https://furgaljc.wixsite.com/materialsworkshop>