

Morgan G. Barnes

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RESEARCH INTERESTS

Polymers, liquid crystal elastomers, shape-shifting materials, covalent organic frameworks

EDUCATION

Rice University

Ph.D. Materials Science and Nanoengineering

Houston, TX

May 2016 - August 2021

Duke University

M.S. Mechanical Engineering and Materials Science

Durham, NC

August 2013 - May 2015

Baylor University

B.S. Mechanical Engineering, Honors

Waco, TX

August 2009 - May 2013

EXPERIENCE

Postdoctoral Research Associate

University of Cambridge

Cambridge, UK

September 2021 - September 2023

Working in the Mechanics, Materials, and Design division within the Engineering department to develop functional shape-shifting liquid crystal devices.

Graduate Research Assistant

Rice University

Houston, TX

June 2016 - August 2021

Worked in the Materials Science and NanoEngineering department to develop multi-functional polymers including stimuli-responsive soft actuators and mechanically strong thin films.

ORAU Journeyman Fellow

Army Research Laboratory

Aberdeen, MD

February 2020 - December 2020

Worked in the Weapons and Materials Research Directorate at ARL to synthesize 2D covalent organic framework films for high-strength high-toughness films

Research Technician

Rice University

Houston, TX

January 2016 - May 2016

Worked in the Bioengineering department operating a high resolution microendoscope in a clinical environment and developed data analysis protocols using Python

MRSEC Fellow

Duke University

Durham, NC

August 2013 - May 2015

Worked in the NSF Triangle Materials Research and Engineering center (MRSEC) using AFM force spectroscopy to investigate the crosslinking of click-coupled poly-protein gels

Undergraduate Honors Research Assistant

Baylor University

Waco, TX

August 2011 - May 2013

Worked in the Mechanical Engineering department determining the time-temperature viscoelastic properties of bulk polymers

PUBLICATIONS

13. **M. Barnes**, D. McLeod, R. Lambeth. *A Scalable Method for Producing Highly-Crystalline, Free-Standing Covalent Organic Framework Films Directly from Monomer Solutions*. Submitted.
12. A. Khater, S. Bhattacharyya, M. Saadi, **M. Barnes**, M. Lou, V. Harikrishnan, S.M. Sajadi, P.J. Boul, C.S. Tiwary, H. Zhu, M.M. Rahman, P. Ajayan. *Processing Dynamics of 3D-Printed Carbon Nanotubes-Epoxy Composites*. Submitted.
11. S. Susarla, G. Chilkoor, Y. Cui, T. Arif, A. Puthirath, T. Tsafack, P. Sudeep, S. Castro-Pardo, **M. Barnes**, R. Verduzco, N. Koratkar, T. Filleter, G. Venkataramana, M. Rahman, P. Ajayan. *Corrosion Resistance of Sulfur-Selenium Alloy Coatings*. Submitted.
10. D. Zhu, Z. Hu, T. K. Rogers, **M. Barnes**, C. Tseng, H. Mei, L. M. Sassi, Z. Zhang, M. M. Rahman, P. M. Ajayan, R. Verduzco, *Patterning, Transfer, and Tensile Testing of Covalent Organic Framework Films with Nanoscale Thickness*. Chem. Mater. 2021.
9. D. Zhu, G. Xu, **M. Barnes**, Y. Li, C. P. Tseng, Z. Zhang, J. J. Zhang, Y. Zhu, S. Khalil, M. M. Rahman, R. Verduzco, P. M. Ajayan, *Covalent Organic Frameworks for Batteries*. Adv. Funct. Mater. 2021.
8. D. Zhu, Y. Zhu, Q. Yan, **M. Barnes**, F. Liu, P. Yu, C.-P. Tseng, N. Tjahjono, P.-C. Huang, M. M. Rahman, E. Egap, P. M. Ajayan, R. Verduzco. *Pure Crystalline Covalent Organic Framework Aerogels*. Chem. Mater. 2021.
7. D. Zhu, Z. Zhang, Y. Li, **M. Barnes**, S. Khalil, M.M. Rahman, P. Ajayan, R. Verduzco. *Rapid, Ambient Temperature Synthesis of Imine Covalent Organic Frameworks Catalyzed by Transition Metal Nitrates*. Chem. Mater. 2021.
6. D. Zhu, X. Li, Y. Li, **M. Barnes**, C. Tseng, S. Khalil, M.M. Rahman, P. Ajayan, R. Verduzco. *Transformation of One-Dimensional Linear Polymers into Two-Dimensional Covalent Organic Frameworks Through Sequential Reversible and Irreversible Chemistries*. Chem. Mater. 2020.
5. **M. Barnes**, S. Sajadi, S. Parekh, M. M. Rahman, P. M. Ajayan, R. Verduzco, *Reactive 3D Printing of Shape Programmable Liquid Crystal Elastomer Actuators*. ACS Appl. Mater. Interfaces 2020.
4. S. Jung, Y. Cui, **M. Barnes**, C. Satam, S. Zhang, R. A. Chowdhury, A. Adumbumkulath, O. Sahin, C. Miller, S. M. Sajadi, L. M. Sassi, Y. Ji, M. R. Bennett, M. Yu, J. Friguglietti, F. A. Merchant, R. Verduzco, S. Roy, R. Vajtai, J. C. Meredith, J. P. Youngblood, N. Koratkar, M. M. Rahman, P. M. Ajayan, *Multifunctional Bio-Nanocomposite Coatings for Perishable Fruits*. Adv. Mater. 2020.
3. M. M. Rahman, A. B. Puthirath, A. Adumbumkulath, T. Tsafack, H. Robatjazi, **M. Barnes**, Z. Wang, S. Kommandur, S. Susarla, S. M. Sajadi, D. Salpekar, F. Yuan, G. Babu, K. Nomoto, S. Islam, R. Verduzco, S. K. Yee, H. G. Xing, P. M. Ajayan, *Fiber Reinforced Layered Dielectric Nanocomposite*. Adv. Funct. Mater. 2019.
2. **M. Barnes**, R. Verduzco. *Direct Shape Programming of Liquid Crystal Elastomers*. Soft Matter 2019.
1. B. Zhu, **M. Barnes**, H. Kim, M. Yuan, H. Ardebili, and R. Verduzco. *Molecular engineering of step-growth liquid crystal elastomers*. Sensors Actuators B Chem. 2017.

PRESENTATIONS AND POSTERS

Naval Research Laboratory

Invited Seminar, Virtual due to COVID-19

Double Network Liquid Crystal Elastomer Actuators

Washington D.C.

January 2021

American Chemical Society Spring Meeting

Contributed Talk, Virtual due to COVID-19

Reactive 4D Printing of Mechanically Programmable Liquid Crystal Elastomer Actuators

Philadelphia, PA

March 2020

American Physical Society March Meeting

Contributed Talk, Virtual due to COVID-19

4D Printing of Mechanically Programmable Shape-Shifting Liquid Crystal Elastomers

Denver, CO

March 2020

International Liquid Crystal Elastomer Conference <i>Contributed Talk</i> Reactive 3D-Printing of Liquid Crystal Elastomers for Non-Linear Actuation	Eindhoven, Netherlands <i>September 2019</i>
American Physical Society March Meeting <i>Contributed Talk</i> Programming Complex and Arbitrary Shape Changes in Liquid Crystal Elastomers	Boston, MA <i>March 2019</i>
Texas Soft Matter Meeting <i>Contributed Talk</i> Mechanically Programming Complex Reversible Shape Changes in Liquid Crystal Elastomers	Austin, TX <i>August 2018</i>
Smalley-Curl Institute Summer Research Symposium <i>Selected Talk</i> Flat Sheets to 3D Images and Back: Programming Shape-Shifting Elastomers into Flowers, Faces, and More	Houston, TX <i>August 2018</i>
American Chemical Society National Meeting <i>Poster</i> Exploring the uses of a two-stage thiol-acrylate reaction for liquid crystal elastomers	Washington DC <i>August 2017</i>
Smalley-Curl Institute Transdisciplinary Symposium <i>Contributed Talk</i> Extrusion-Aligned Liquid Crystal Elastomer Fibers	Houston, TX <i>February 2017</i>
Texas Soft Matter Meeting <i>Contributed Talk</i> Step-Growth Liquid Crystal Elastomers with Low Glass Transition Temperatures	Dallas, TX <i>August 2016</i>
North Carolina State University Industry Symposium <i>Poster</i> Self-Assembled Biomaterials Using Streptavidin and SpyTag-SpyCatcher	Raleigh, NC <i>February 2015</i>
Duke University Frontiers Day <i>Poster</i> Self-Assembled Protein-Based Soft Materials with Tailorable Viscoelastic Properties	Durham, NC <i>May 2014</i>

AWARDS AND HONORS

- Best Overall Presentation, MSNE Graduate Student Seminar, 2021
- 2019 Soft Matter Outstanding Student Paper Award, Royal Society of Chemistry, 2020
- ORAU Journeyman Fellowship, Army Research Laboratory, 2020
- Best Student Lecturer award, International Liquid Crystal Elastomer Conference, Netherlands, 2019
- Future Faculty Fellowship, Rice University, 2019
- NSF Future Faculty Workshop Travel Award, Princeton University, 2019
- Best Presentation award, Smalley-Curl Institute Summer Research Symposium, Rice University, 2018
- Outstanding Teacher's Assistant Award, Rice University, 2018
- Best Presentation award, Smalley-Curl Institute Transdisciplinary Symposium, Rice University, 2016
- Triangle Materials Research Science and Engineering Center (MRSEC) Fellowship, 2013
- Outstanding Engineering Senior award, Baylor University, 2013
- Who's Who Among Students in American Universities and Colleges award, Baylor University, 2013
- Presidents Gold Scholarship, Baylor University, 2009-2013

KEY SKILLS

Matlab, Python, L^AT_EX, DMA, DSC, TGA, AFM Spectroscopy, NMR, GPC, XRD, organic synthesis, FTIR, rheology

TEACHING

MSNE 303: Junior Lab

Teaching Assistant

Houston, TX

Spring 2017, 2018, 2019

Organized, instructed and graded the labs for the departmental undergraduate junior lab

MSNE 555: Bio-Mimetic Strategies

Guest Lecturer

Houston, TX

Spring 2019

Guest lectured for a bio-mimetics course covering soft shape-shifting materials and anti-fouling techniques

MENTORSHIP AND ENGAGEMENT

ARO High School and Undergraduate Apprenticeship Program

Mentor

Houston, TX

June - August 2019

Mentored an undergraduate and high school student during the summer through the Army Research Office (ARO) Undergraduate Research Apprenticeship Program (URAP) and High School Apprenticeship Program (HSAP) grant to develop self-pumping microfluidic liquid crystal elastomer devices

NSF Nano in Schools

Guest Lecturer

Houston, TX

January 2019

Was a guest lecturer at local high school chemistry classroom to expose students to graduate school, research, and shape-shifting materials

NSF Research Education for Teachers (RET)

Mentor

Houston, TX

June - August 2018

Mentored a high school teacher in a summer research project as part of the NSF Nanosystems Engineering Research Center for Nanotechnology-Enabled Water Treatment (NEWTE) RET program

CampSpark!

Activity Leader

Houston, TX

July 2017

Designed and taught a hands-on introductory polymer lesson for CampSpark!, a week long research camp for local refugees hosted by Rice University

Scientific Research Design (SRD)

Mentor

Houston, TX

July 2016 - May 2017

Mentored a local high school student in a research project for the school year as part of a SRD high school course

Rice's Institute of Biosciences and Bioengineering (IBB) Stem Engagement

Mentor

Houston, TX

July 2016

Mentored a high school student from the Science Academy of South Texas for a week long research experience hosted by Rice's IBB

Baylor Capstone Engineering Courses

Project Manager

Waco, TX

January - December 2012

Chosen by professors to act as project manager for two separate capstone Baylor engineering courses

Goodwill Adult Education

Tutor

Waco, TX

September 2010 - May 2013

Volunteered regularly with the local Goodwill's ongoing education classes to prepare adults for the GED