Morgan G. Barnes

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RESEARCH INTERESTS

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

EDUCATION

Rice University **Houston, TX**
Ph.D. Materials Science and Nanoengineering *May 2016 - August 2021*

Duke University **Durham, NC**
M.S. Mechanical Engineering and Materials Science *August 2013 - May 2015*

Baylor University **Waco, TX**
B.S. Mechanical Engineering, Minor in Mathematics, Honors *August 2009 - May 2013*

EXPERIENCE

Postdoctoral Research Associate **Cambridge, UK**
University of Cambridge *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 **Houston, TX**
Rice University *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 **Aberdeen, MD**
Army Research Laboratory *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 **Houston, TX**
Rice University *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 **Durham, NC**
Duke University *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 Research Assistant **Austin, TX**
University of Texas *May 2012 - August 2012*
Worked in the Geotechnical Engineering department to study soil wetting and created data acquisition systems

Undergraduate Honors Research Assistant **Waco, TX**
Baylor University *August 2011 - May 2013*
Worked in the Mechanical Engineering department to determine the time-temperature viscoelastic properties of bulk polymers

PUBLICATIONS

15. **M. Barnes**, S. Cetinkaya, A. Ajnsztajn, R. Verduzco. *Effects and Potential Applications of Liquid Crystal Elastomers with Reduced Liquid Crystal Content*. Submitted.
14. S. Khalil, M. Meyer, M. Samani, C. Huang, **M. Barnes**, A. Marciel, R. Verduzco. *Enabling Solution Processible COFs through Suppression of Precipitation during Solvothermal Synthesis*. Submitted.
13. 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.
12. **M. Barnes**, D. McLeod, R. Lambeth. *Highly Crystalline, Free-Standing Covalent Organic Framework Films Produced Directly from Monomer Solutions*. ACS Appl. Polym. Mater. 2022.
11. S. Susarla, G. Chilkoor, J. R. Kalimuthu, M. A. S. R. Saadi, Y. Cui, T. Arif, T. Tsafack, A. B. Puthirath, P. Sigdel, B. Jasthi, P. M. Sudeep, L. Hu, A. Hassan, S. Castro-Pardo, **M. Barnes**, S. Roy, R. Verduzco, M. G. Kibria, T. Filleter, H. Lin, S. D. Solares, N. Koratkar, V. Gadhamshetty, M. M. Rahman, P. M. Ajayan. *Corrosion Resistance of Sulfur–Selenium Alloy Coatings*. Adv. Mater. 2021.
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

University of Cambridge — **Cambridge, UK**
Invited Bio- & Micro-Mechanics Seminar — *October 2021*
Mechanically Programmable Liquid Crystal Elastomers

Naval Research Laboratory **Washington D.C.**
Invited Seminar, Virtual due to COVID-19 *January 2021*
Double Network Liquid Crystal Elastomer Actuators

American Chemical Society Spring Meeting **Philadelphia, PA**
Contributed Talk, Virtual due to COVID-19 *March 2020*
Reactive 4D Printing of Mechanically Programmable Liquid Crystal Elastomer Actuators

American Physical Society March Meeting **Denver, CO**
Contributed Talk, Virtual due to COVID-19 *March 2020*
4D Printing of Mechanically Programmable Shape-Shifting Liquid Crystal Elastomers

International Liquid Crystal Elastomer Conference **Eindhoven, Netherlands**
Contributed Talk *September 2019*
Reactive 3D-Printing of Liquid Crystal Elastomers for Non-Linear Actuation

American Physical Society March Meeting **Boston, MA**
Contributed Talk *March 2019*
Programming Complex and Arbitrary Shape Changes in Liquid Crystal Elastomers

Texas Soft Matter Meeting **Austin, TX**
Contributed Talk *August 2018*
Mechanically Programming Complex Reversible Shape Changes in Liquid Crystal Elastomers

Smalley-Curl Institute Summer Research Symposium **Houston, TX**
Selected Talk *August 2018*
Flat Sheets to 3D Images and Back: Programming Shape-Shifting Elastomers into Flowers, Faces, and More

American Chemical Society National Meeting **Washington DC**
Poster *August 2017*
Exploring the uses of a two-stage thiol-acrylate reaction for liquid crystal elastomers

Smalley-Curl Institute Transdisciplinary Symposium **Houston, TX**
Contributed Talk *February 2017*
Extrusion-Aligned Liquid Crystal Elastomer Fibers

Texas Soft Matter Meeting **Dallas, TX**
Contributed Talk *August 2016*
Step-Growth Liquid Crystal Elastomers with Low Glass Transition Temperatures

North Carolina State University Industry Symposium **Raleigh, NC**
Poster *February 2015*
Self-Assembled Biomaterials Using Streptavidin and SpyTag-SpyCatcher

Duke University Frontiers Day **Durham, NC**
Poster *May 2014*
Self-Assembled Protein-Based Soft Materials with Tailorable Viscoelastic Properties

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 Trandisciplinary 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, LaTeX, DMA, DSC, TGA, AFM Spectroscopy, NMR, GPC, XRD, organic synthesis, FTIR, rheology

TEACHING

MSNE 303: Junior Lab **Houston, TX**
Teaching Assistant *Spring 2017, 2018, 2019*
Organized, instructed and graded the labs for the departmental undergraduate junior lab

MSNE 555: Bio-Mimetic Strategies **Houston, TX**
Guest Lecturer *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 **Houston, TX**
Mentor *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 **Houston, TX**
Guest Lecturer *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) **Houston, TX**
Mentor *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 (NEWT) RET program

CampSpark! **Houston, TX**
Activity Leader *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) **Houston, TX**
Mentor *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 **Houston, TX**
Mentor *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 **Waco, TX**
Project Manager *January - December 2012*
Chosen by professors to act as project manager for two separate capstone Baylor engineering courses

Goodwill Adult Education **Waco, TX**
Tutor *September 2010 - May 2013*
Volunteered regularly with the local *Goodwill*'s ongoing education classes to prepare adults for the GED