

# Morgan G. Barnes

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## RESEARCH INTERESTS

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

## EDUCATION

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### Rice University

Houston, TX

*Ph.D., Materials Science and Nanoengineering*

*May 2016 - Summer 2021 (Expected)*

- Advisor: Dr. Rafael Verduzco
- Dissertation (working title): "Designing anisotropic polymers: from shape shifting elastomers to strong two-dimensional films"

### Duke University

Durham, NC

*M.S. Mechanical Engineering and Materials Science*

*August 2013 - May 2015*

- Advisor: Dr. Piotr Marszalek
- Thesis: "Self-assembled protein-based biomaterials with tailorable physical properties"

### Baylor University

Waco, TX

*B.S. Mechanical Engineering, Honors*

*August 2009 - May 2013*

- Advisor: Dr. David Jack
- Honors Thesis: "Modeling and Predicting the Behavior of Viscoelastic Materials"

## EXPERIENCE

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### ORAU Journeyman Fellow

Aberdeen, MD

*Army Research Laboratory*

*February 2020 - December 2020*

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

### Graduate Research Assistant

Houston, TX

*Rice University*

*June 2016 - Summer 2021 (Expected)*

Working in the Materials Science and NanoEngineering department to develop multi-functional polymers including stimuli-responsive soft actuators and mechanically strong thin 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 Honors Research Assistant

Waco, TX

*Baylor University*

*August 2011 - May 2013*

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

## TEACHING

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### MSNE 303: Junior Lab

Teaching Assistant

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

Houston, TX

Spring 2017, 2018, 2019

### MSNE 555: Bio-Mimetic Strategies

Guest Lecturer

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

Houston, TX

Spring 2019

## PUBLICATIONS

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10. 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.
9. 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.
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. Robotjazi, **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

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### 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

<b>American Physical Society March Meeting</b> <i>Contributed Talk, Virtual due to COVID-19</i> 4D Printing of Mechanically Programmable Shape-Shifting Liquid Crystal Elastomers	<b>Denver, CO</b> <i>March 2020</i>
<b>International Liquid Crystal Elastomer Conference</b> <i>Contributed Talk</i> Reactive 3D-Printing of Liquid Crystal Elastomers for Non-Linear Actuation	<b>Eindhoven, Netherlands</b> <i>September 2019</i>
<b>American Physical Society March Meeting</b> <i>Contributed Talk</i> Programming Complex and Arbitrary Shape Changes in Liquid Crystal Elastomers	<b>Boston, MA</b> <i>March 2019</i>
<b>Texas Soft Matter Meeting</b> <i>Contributed Talk</i> Mechanically Programming Complex Reversible Shape Changes in Liquid Crystal Elastomers	<b>Austin, TX</b> <i>August 2018</i>
<b>Smalley-Curl Institute Summer Research Symposium</b> <i>Selected Talk</i> Flat Sheets to 3D Images and Back: Programming Shape-Shifting Elastomers into Flowers, Faces, and More	<b>Houston, TX</b> <i>August 2018</i>
<b>American Chemical Society National Meeting</b> <i>Poster</i> Exploring the uses of a two-stage thiol-acrylate reaction for liquid crystal elastomers	<b>Washington DC</b> <i>August 2017</i>
<b>Smalley-Curl Institute Transdisciplinary Symposium</b> <i>Contributed Talk</i> Extrusion-Aligned Liquid Crystal Elastomer Fibers	<b>Houston, TX</b> <i>February 2017</i>
<b>Texas Soft Matter Meeting</b> <i>Contributed Talk</i> Step-Growth Liquid Crystal Elastomers with Low Glass Transition Temperatures	<b>Dallas, TX</b> <i>August 2016</i>
<b>North Carolina State University Industry Symposium</b> <i>Poster</i> Self-Assembled Biomaterials Using Streptavidin and SpyTag-SpyCatcher	<b>Raleigh, NC</b> <i>February 2015</i>
<b>Duke University Frontiers Day</b> <i>Poster</i> Self-Assembled Protein-Based Soft Materials with Tailorable Viscoelastic Properties	<b>Durham, NC</b> <i>May 2014</i>

## AWARDS AND HONORS

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- 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

## LEADERSHIP AND ENGAGEMENT

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### **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 (NEWTE) 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

## KEY SKILLS

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Matlab, Python, L<sup>A</sup>T<sub>E</sub>X, DMA, DSC, TGA, AFM Spectroscopy, NMR, GPC, XRD, organic synthesis, FTIR, rheology

## ASSOCIATIONS

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- American Chemical Society
- American Physical Society
- Pi Tau Sigma, National Mechanical Engineering Honors Society