

**Zachary Ahmad** (*he/him*)

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**I. Education**

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**California Institute of Technology (Caltech)**

Pursuing Ph.D. in Materials Science

Advisor: Katherine Faber

**The University of Southern Mississippi (USM)**

B.S. in Polymer Science and Engineering (ABET Accredited) | Minor in Chemistry

May 2022, *Magna Cum Laude*Thesis: *Compatible Blends of n-Type Polymer Semiconductors: Impact on the Morphology and Mechanics of Flexible Optoelectronics***II. Research Experience**

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2022 - Present

**Graduate Researcher**

Katherine Faber Group | Caltech

- Currently developing new methods of additive manufacturing for high temperature materials in collaboration with **NASA's Jet Propulsion Laboratory**
- Characterizing the reaction kinetics and microstructural evolution of materials in a reaction bonding process as coupled with additive manufacturing.

2023 - Present

**Visiting Researcher**

Mech. Fabrication &amp; Test Section 357 | NASA Jet Propulsion Laboratory

- Developing the kinetic models for structural control processes that design ordered, reproducible, and dimensionally uniform porous structures for spacecraft assimilation.
- Characterizing the physical, chemical, and mechanical behavior of materials manufactured through a novel additive manufacturing process to establish property-processing relationships in aluminum oxide-based systems.

Summer 2022

**NASA Proposal Writing & Evaluation Experience (NWPEE)**

National Aeronautics and Space Administration | Virtual

- Worked in a multi-disciplinary team to develop innovative proposals for new technologies and concepts that enable NASA objectives and enhance mission capabilities
- Wrote, reviewed, and scored proposals through the lens of a NASA reviewer

2019 – 2022

**Undergraduate Researcher**

Xiaodan Gu Research Group

School of Polymer Science and Engineering | USM

- Investigated the morphology of semiconducting polymers for applications in solar cells
- Studied mechanics of conjugated polymer blends for improvement of optoelectronic devices
- Performed X-ray diffraction studies for academic and industry professionals via SAXS/WAXS

Summer 2021

**Research Intern**

Reika Katsumata Research Group  
Department of Polymer Science and Engineering | UMass Amherst

- Led independent project studying the dewetting patterns of thin film polymers
- Performed contact angle measurements to quantify wetting for multi-layered systems
- Presented weekly literature reviews to faculty and graduate students

2020 – 2021

**Research Scholar**

Ronald E. McNair Scholar Program | USM

- Developed an independent project that addressed the balance of ductility and electrical performance in organic devices
- Assembled a comprehensive literature review regarding advances in OFET devices

Summer 2020

**Research and Development Intern**

Heritage Plastics, Inc. | Picayune, MS

- Planned experiments to test the performance of products designed with various mineral fillers
- Reverse engineered defective products to determine source of defect
- Prepared polymer samples via injection molding, blow molding, compression molding, etc

**III. Awards and Scholarships**

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2024	New Horizons Diversity, Equity, and Inclusion Award
2024	Keck Institute for Space Science Affiliate
2022	<b>NSF Graduate Research Fellowship</b>
2022	<b>Engineering &amp; Applied Science Chair Scholars Fellowship, Caltech</b>
2022	<b>Knight-Hennessy Scholarship, Stanford (Finalist)</b>
2022	Excellence in Research Award – USM Honors College
2022	Honors College Research Persistence Award
2022	Who’s Who Leadership Award at USM
2021	<b>Barry M. Goldwater Scholarship</b>
2021	Olliphant Honors Scholarship
2021	University of Southern Mississippi Undergraduate Symposium – <b>1st Place</b> Materials Synthesis, Modification and Analysis Poster
2021	Mississippi Honors Conference – <b>1st Place</b> STEM Poster

2021	Mississippi Manufacturers Association Scholarship
2020	<b>Ronald E. McNair Scholar</b>
2020	CIEF Frank Borrelle Leadership Scholarship
2020	Honors Keystone Scholarship
2020	Kristen Bower Scholarship
2020	School of Polymer Science and Engineering Student of the Month (January 2020)

#### **IV. Teaching and Mentoring Experience**

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2023 – Present	<p><b>Inaugural Chair of Graduate Student Advisory Board</b> Engineering and Applied Science Division   Caltech</p> <ul style="list-style-type: none"> <li>• Spearheaded the first EAS Graduate Student Advisory Board, aligning activities with divisional goals and enhancing student program quality.</li> <li>• Partnered in developing student-focused initiatives, addressing holistic academic and social needs.</li> <li>• Served as a liaison for student engagement and advocacy, streamlined communication, and facilitated community-building efforts.</li> </ul>
2023 – Present	<p><b>Caltech Peer Mentor</b> Graduate Summer Research Institute Student Faculty Programs   Caltech</p> <ul style="list-style-type: none"> <li>• Mentoring six first-year graduate students from underrepresented backgrounds in higher education.</li> <li>• Provide advice and assistance to the students in a range of topics from choosing appropriate classes that align with their interests, to identifying resources on campus that aid in their success.</li> </ul>
2021 – 2022	<p><b>Research Mentor</b> Xiaodan Gu Research Group School of Polymer Science and Engineering   USM</p> <ul style="list-style-type: none"> <li>• Trained and supervised a 2nd year undergraduate in SAXS/WAXS, AFM, and mechanical testing methods</li> <li>• Mentored 4 additional students per semester in laboratory research activities</li> </ul>
2018 – 2019	<p><b>Learning Assistant</b> Mathematics Department   USM</p> <ul style="list-style-type: none"> <li>• Tutored students in group settings and one-on-one for college algebra classes</li> <li>• Independently led class meetings for small groups of students</li> </ul>

#### **V. Publications**

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##### **A. Statistics via Google Scholar**

Peer-reviewed publications: 6  
h-index: 5  
Total citations: 323

Number of high-impact factor (IF>10) articles: 4  
ORCID iD: 0000-0002-3308-8198

## B. Publications List

- 2022 Galuska, L.; Ocheje, M.; **Ahmad, Z.**; Rondeau-Gagné, S.; Gu, X. Elucidating the Role of Hydrogen Bonds for Improved Mechanical Properties in a High-Performance Semiconducting Polymer. *Chem. Mater.* **2022**, DOI: 10.1021/acs.chemmater.1c04055
- 2021 Zhang, Q.; Conkle, K.; **Ahmad, Z.**; Ray, P.; Kolodziejczyk, W.; Hill, G.; Gu, X.; Dai, Q. (FA0.83MA0.17)0.95Cs0.05Pb(I0.83Br0.17)3 Perovskite Films Prepared by Solvent Volatilization for High-Efficiency Solar Cells. *Solar RRL.* **2021**, *5*, 2100640. DOI: 10.1002/solr.202100640
- 2021 Zhang, S.; Alesadi, A.; Mason, G.T.; Chen, K.L.; Freychet, G.; Galuska, L.; Cheng, Y.H.; St. Onge, P.B.J.; Ocheje, M.U.; Ma, G.; Qian, Z.; Dhakal, S.; **Ahmad, Z.**; Wang, C.; Chiu, Y.; Rondeau-Gagne, S.; Xia, W.; Gu, X. Molecular Origin of Strain-Induced Chain Alignment in PDPP-Based Semiconducting Polymeric Thin Films. *Adv. Funct. Mater.* **2021**, *31*, 2100161. DOI: 10.1002/adfm.202100161
- 2021 Li, B.; Zhang, Q.; Zhang, S.; **Ahmad, Z.**; Chidanguro, T.; Davis, A.H.; Simon, Y.C.; Gu, X.; Zheng, W.; Pradhan, N.; Dai, Q. Spontaneously Supersaturated Nucleation Strategy for High Reproducible and Efficient Perovskite Solar Cells. *Chem. Eng. J.* **2021**, *405*, 126998. DOI: 10.1016/J.Cej.2020.126998
- 2020 Li, Q.Y.; Yao, Z.F.; Lu, Y.; Zhang, S.; **Ahmad, Z.**; Wang, J.Y.; Gu, X.; Pei, J. Achieving High Alignment of Conjugated Polymers by Controlled Dip-Coating. *Adv. Elec. Mater.* **2020**, *6*, 2000080. DOI: 10.1002/aelm.202000080
- 2019 Yan, X.; Xiong, M.; Li, J.T.; Zhang, S.; **Ahmad, Z.**; Lu, Y.; Wang, Z.Y.; Yao, Z.F.; Wang, J.Y.; Gu, X.; Lei, T. Pyrazine-Flanked Diketopyrrolopyrrole (DPP): A New Polymer Building Block for High-Performance n-Type Organic Thermoelectrics. *J. Am. Chem. Soc.* **2019**, *141*, 20215-20221. DOI: 10.1021/jacs.9b10107

## VI. Presentations

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- 2024 Ahmad, Z. et al. *Additive Manufacturing of High-Temperature Ceramic Components via Reaction Bonding*. 48th International Conference and Exposition on Advanced Ceramics and Composites, Oral, Daytona Beach, FL.
- 2021 Ahmad, Z. *Compatible Conjugated Blends: Impact on the Morphology and Mechanics of Flexible Electronics*. American Chemical Society Spring Meeting, Virtual, Oral.
- 2021 Ahmad, Z. *Compatible Conjugated Blends: Impact on the Morphology and Mechanics of Flexible Electronics*. 48th Annual Waterborne Symposium, Virtual, Poster.

- 2021 Ahmad, Z. *Compatible Conjugated Blends: Impact on the Morphology and Mechanics of Flexible Electronics*. Mississippi Honors Conference, Virtual, Poster. **(1st Place)**
- 2021 Ahmad, Z. *Compatible Conjugated Blends: Impact on the Morphology and Mechanics of Flexible Electronics*. Undergraduate Symposium, USM, Virtual, Poster. **(1st Place)**
- 2021 Ahmad, Z. *Effect of Backbone Rigidity on Ductility for Optoelectronic Applications*. NSF EPSCoR: CEMOS Site Visit, Virtual, Oral.
- 2021 Ahmad, Z. *Blends of Partially and Fully Conjugated Polymers for High Ductility and Electrical Performance in Optoelectronics*. Mississippi McNair Scholars Symposium, Oral.

## **VIII. Outreach and Involvement**

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### **Professional Memberships**

American Chemical Society (Member 2020 – Present)  
 Society for Industrial and Applied Mathematics (Member 2019 - Present)  
 Society for the Advancement of Material and Process Eng. (**President** of USM Chapter 2021)  
 American Ceramic Society (Member 2023 – Present)

### **Academic Memberships**

**Sigma Xi** Research Honor Society (Associate Member 2021 - Present)  
 National Society of Leadership and Success (Member 2022 - Present)

### **Campus & Community Involvement**

Caltech EAS Graduate Student Advisory Board (**Founder and Chair** 2024 - Present)  
 U.S. Graduate Student Action Network (**Leadership Board** 2022 – 2023)  
 Caltech Graduate Student Council (**Director** 2022 -2024)  
 Caltech EAS Committee on Diversity, Equity, and Inclusion (**Committee Member** 2022 – Present)  
 Caltech PRISM/oSTEM (**Leadership Councilor** 2022)  
 Mississippi Council for the Blind (**Councilor** 2017 - 2022)  
 USM Honors College Leadership Council (**Vice President** 2021)  
 USM Polymer Science Association (**Chair of Diversity** 2021, **President** 2020, **Treasurer** 2019)  
 USM Women in Science and Engineering (Honorary Member 2020-2022)

## **IX. Skills**

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### *Materials Characterization:*

SEM, EDS, XRD, SAXS/WAXS, AFM, UV-Vis, DSC, TGA, DMA, OIT, NMR, IR, Mass-Spec, Ellipsometry, Goniometry

### *Modeling & Numerical:*

MATLAB, Python, C++

*Processing Systems:*

Laser Powder Bed Fusion Additive Manufacturing, Reaction Bonding of Oxides, Batch Reactors, Continuous Reactors, Carbon Fiber Prepreg, Autoclave, Injection Molding, Compression Molding, Blow Molding, RTM, VARTM