

Zachary A. Chase (*he/him*)

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I. Education

California Institute of Technology (Caltech)

Pursuing Ph.D. in Materials Science

Advisor: Katherine Faber

Caltech

M.S. in Materials Science

June 2024 | 3.8/4.0 GPA

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**

2022 - Present

Graduate Researcher | Caltech

Katherine Faber Research Group

- Developing a hybrid additive manufacturing approach integrating laser powder bed fusion (LPBF) and reaction bonding (RB) for high-temperature ceramic fabrication in collaboration with NASA's Jet Propulsion Laboratory.
- Investigating phase transformations, oxidation kinetics, and volumetric expansion effects to optimize material densification and thermal stability.
- Utilizing characterization techniques (XRD, SEM/EDS, TGA) to analyze microstructural evolution and interfacial properties in LPBF-RB processed ceramics.

2023 - Present

Visiting Student Researcher | NASA Jet Propulsion Laboratory

Mech. Fabrication & Test Section 357

- **Co-led Materials International Space Station flight experiment (MISSE-21, JAXA HTV-X1)** on high-temperature oxide ceramics; fabricated flight coupons with JPL engineers and delivered for low Earth orbit exposure to atomic oxygen and radiation; responsible for pre-flight characterization and post-flight analysis plan (XRD, SEM/EDS, TGA). *Status as of Oct 2025: onboard ISS; awaiting return for evaluation.*
- 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.

2019 – 2022	Undergraduate Researcher USM Xiaodan Gu Research Group School of Polymer Science and Engineering - 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 UMass Amherst Reika Katsumata Research Group Department of Polymer Science and Engineering - 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 USM Ronald E. McNair Scholar Program - 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 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 Fellowships

2025	Young Science Star, Young Scientist Hub
2024	Dean's Leadership Award, Caltech
2024	New Horizons Diversity, Equity, and Inclusion Award
2024	Keck Institute for Space Studies Affiliate
2022	NSF Graduate Research Fellowship
2022	Engineering & Applied Science Chair Scholars Fellowship, Caltech
2022	Knight-Hennessy Scholarship, Stanford (Finalist)
2022	Excellence in Research Award – USM Honors College
2022	Honors College Research Persistence Award
2022	Who's Who Leadership Award at USM

2021	Barry M. Goldwater Scholarship
2021	Olliphant Honors Scholarship
2021	University of Southern Mississippi Undergraduate Symposium – 1st Place Materials Synthesis, Modification and Analysis Poster
2021	Mississippi Honors Conference – 1st Place STEM Poster
2021	Mississippi Manufacturers Association Scholarship
2020	Ronald E. McNair Scholarship
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

2024 - Present	Undergraduate Research Mentor Caltech Katherine Faber Research Group • Mentored Audrey Chyung in optimizing sintering protocols for laser-printed and reaction-bonded alumina ceramics in collaboration with NASA's Jet Propulsion Laboratory. • Advised on experimental design, materials characterization (SEM, EDS, XRD), and data analysis to improve processing efficiency and material integrity.
2023 – Present	Teaching Assistant Caltech Engineering and Applied Science Division • Led office hours, developed assignments, and graded coursework for <i>MS 115: Fundamentals of Materials Science</i>. • Delivered lectures in place of the instructor, reinforcing core concepts in materials structure, properties, and processing.
2023 – Present	Inaugural Chair of Graduate Student Advisory Board Engineering and Applied Science Division Caltech • Spearheaded the first EAS Graduate Student Advisory Board, aligning activities with divisional goals and enhancing student program quality. • Partnered in developing student-focused initiatives, addressing holistic academic and social needs. • Served as a liaison for student engagement and advocacy, streamlined communication, and facilitated community-building efforts.
2023 – Present	Caltech Peer Mentor Graduate Summer Research Institute Student Faculty Programs Caltech • Mentoring six first-year graduate students from underrepresented backgrounds in higher education.

- 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.

2021 – 2022

Research Mentor

Xiaodan Gu Research Group

School of Polymer Science and Engineering | USM

- Trained and supervised a 2nd year undergraduate in SAXS/WAXS, AFM, and mechanical testing methods
- Mentored 4 additional students per semester in laboratory research activities

2018 – 2019

Learning Assistant

Mathematics Department | USM

- Tutored students in group settings and one-on-one for college algebra classes
- Independently led class meetings for small groups of students

V. Publications

A. Statistics via Google Scholar

Peer-reviewed publications: 8

h-index: 6

Total citations: 498

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B. Publications List

- 2025 **Chase Z**; Seager, T.; Cheikh, D.; Li, B. C.-Y.; McEnerney, B.; Guerra, J.; Borgonia, J. P.; Firdosy, S.; Faber, K. T. Integrating laser-powder bed fusion and reaction bonding: A hybrid approach to high-temperature ceramic fabrication. *Scr. Mater.* **2025**, 268, 116881. DOI: 10.1016/j.scriptamat.2025.116881
- 2024 Mehrehjedy A, Kumar P, **Chase Z**, et al. “Fast and Facile Synthesis of Cobalt-Doped ZIF-8 and Fe₃O₄/MCC/Cobalt-Doped ZIF-8 for the Photodegradation of Organic Dyes under Visible Light,” *ACS Omega*. <https://pubs.acs.org/doi/full/10.1021/acsomega.4c06142>
- 2022 Galuska L, Ocheje M, **Chase 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.; **Chase, 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.;

- Chase, 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.; **Chase, 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.; **Chase, 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.; **Chase, 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. Patents

Firdosy, S.; Faber, K.; Chase, Z.; et al. Reaction Bonding of Ceramics via Fusion Additive Manufacturing. Provisional. NPO 53202

VII. Presentations

- 2025 Chase, Z. et al. *In-Ga-Activated Al to Al₂O₃ Conversion in Hybrid Laser Powder Bed Fusion*. XIX ECerS Conference, Dresden, Germany.
- 2024 Chase, Z. et al. *Novel Additive Manufacturing of Ceramic Components via Reaction Bonding*. JPL Research Poster Symposium. Poster, JPL, Pasadena, CA.
- 2024 Chase, Z. et al. *Hybrid Additive Manufacturing of High-Temperature Ceramics: Enhancing Densification and Dimensional Accuracy via Reaction Bonding*. International Congress on Ceramics (ICC'10). Oral, Montreal, QC, CAN.
- 2024 Chase, 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 Chase, Z. *Compatible Conjugated Blends: Impact on the Morphology and Mechanics of Flexible Electronics*. American Chemical Society Spring Meeting, Virtual, Oral.
- 2021 Chase, Z. *Compatible Conjugated Blends: Impact on the Morphology and Mechanics of Flexible Electronics*. 48th Annual Waterborne Symposium, Virtual, Poster.
- 2021 Chase, Z. *Compatible Conjugated Blends: Impact on the Morphology and Mechanics of Flexible Electronics*. Mississippi Honors Conference, Virtual, Poster. **(1st Place)**

- 2021 Chase, Z. *Compatible Conjugated Blends: Impact on the Morphology and Mechanics of Flexible Electronics*. Undergraduate Symposium, USM, Virtual, Poster. **(1st Place)**
- 2021 Chase, Z. *Effect of Backbone Rigidity on Ductility for Optoelectronic Applications*. NSF EPSCoR: CEMOS Site Visit, Virtual, Oral.
- 2021 Chase, 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

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 (Caltech Chapter President 2023 - Present)
 National Society of Leadership and Success (Member 2022 - Present)

Campus & Community Involvement

Caltech Graduate Student Council (**Chair** 2025 – Present)
 Caltech EAS Graduate Student Advisory Board (**Founder and Chair** 2024 - 2025)
 U.S. Graduate Student Action Network (**Leadership Board** 2022 – 2023)
 Caltech Graduate Student Council (**Director** 2022 - 2024)
 Caltech EAS Committee on Community and Student Success (**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 (**President** 2020, **Treasurer** 2019)

IX. Skills

Materials Characterization:

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