ANSWER EVIDENCE

What motivates you to earn a Ph.D./PhD.CEP/MSCEP in Chemical Engineering at MIT? (300 words or less)

Directly answers question

Provides succinct summary of accomplishments

What drove me to begin research was the idea of discovery. I wanted to explore beyond the confines of our current knowledge and share what I found on the other side. Now, with three years of research experience, a published second author paper, two first author manuscripts in preparation, and a Goldwater scholarship, I can confidently say I reached that goal. However, my drive to continue has not faltered. In fact, my experiences have shaped this passion into a new form: helping to lead others to their own discoveries. I hope to one day lead a group of researchers in an academic or national lab setting, and it is clear to me that a PhD is the next step towards that goal. Pursuing a graduate degree at MIT in Chemical Engineering will not only enhance my ability to conduct research and make discoveries but will also strengthen my skills to guide others toward their own.

Accomplishments are quantitative

Provides more concrete answer of getting Ph.D.

My undergraduate research experiences opened my eyes to the largely unexplored world at the nanoscale, and how we can manipulate structure and composition on the order of nanometers to optimize and tailor material properties at the macroscale. Specifically, I am intrigued by systems involving self-assembly, where we can leverage chemistry and morphology to generate ordered structures unfeasible with top-down approaches. I would love to explore these systems further in graduate school, and the MIT ChE program provides many opportunities to do so. The Hammond and Doyle groups fit especially well with these interests, utilizing self-assembly and interface science for applications in drug delivery and beyond. The Olsen and Blankschtein groups also align with my interests, utilizing polymer and colloidal science, respectively, to tackle applications ranging from separations to sustainability.

Provides evidence that MIT ChE is right fit

For up to two of your most important scientific, engineering, research, or work experiences over the last four years, describe your specific role, the new knowledge or discovery that you made, and the potential impacts of the project on science or society. (300 words or less per experience)

Concrete description of important research experience

Since my first semester of freshman year, I have been a member of the [redacted] lab, under Prof. [redacted] within the [redacted] Department. Over the last two years, I have been working on a project involving a new method of synthesizing anisotropic polymer particles, utilizing a technique termed solvent assisted phase separation (SAPS). The project began in the summer of 2019, when I serendipitously created a brand-new particle morphology while working on a project involving the creation of micromotors. I quickly recognized the potential of the discovery and proposed studying the system as an independent research project. Over the last two years, I have investigated the applicability and tunability of the system, developed a mechanism for the process, and designed and conducted experiments to prove it. All lab work was conducted by me, with my advisor and the group's graduate students providing support through weekly meetings and fruitful conversation. The project has already produced a number of tangible results: a first place-winning image in the Materials Research Society "Science as Art" competition, a second-place winning poster at the 2021 American Institute of Chemical Engineers (AIChE) Annual Student Conference, and most significantly, an in-progress first-authored publication on the work. I also presented on the work at the 2021 Future Leaders in Chemical Engineering symposium hosted by NC State University. With publication, the SAPS method has the potential to greatly expand the range of morphologies and chemistries researchers have to pick from when tailoring particles towards specific applications. The work's model system, for example, demonstrates unprecedented anisotropic roughness that enhances applications in emulsion stabilization and superhydrophobic coatings. Additionally, to our knowledge the work is the first to specifically take advantage of incomplete phase separation during the introduction of anisotropy, a usually undesired property.

Highlighting 1) novelty and 2) independence

Concrete description of what the author actually did

Quantifying the impact of this research

Putting the impact of this research in context for a non-expert audience

Concrete description of important research experience

Last summer, I took part in an NSF REU program through the University of [redacted], where I worked with Prof. [redacted]. Over the program's ten weeks, I developed Python-based scripts to calculate theoretical light scattering models, specifically geared towards applications with the technique of diffusing wave spectroscopy (DWS). The aim of the project was to consolidate the field's findings and create an easy-to-use, modular tool to generate these models. I completed this work directly under Prof. Furst and was responsible for

Highlighting the purpose of the research

identifying and analyzing relevant literature and textbooks and transcribing their findings into code. This included developing the overall framework for the code and including a range of interchangeable scattering (form factor) and interparticle potential (structure factor) models. I was successful in the endeavor, and by the end of the program I had created a package that could accurately fit experimental data under a wide range of conditions. While the package itself will become an integral part of the group's work, it also has the potential to be utilized by scientists throughout the world. With the goal to be used by researchers both seasoned and inexperienced in the field, I aimed to make the code as accessible as possible, compiling a comprehensive documentation and creating scripts to demonstrate its use. With the support of a postdoctoral student in the group, I am also drafting a first-authored manuscript with the intention to submit to Physical Review E. The paper, which would accompany a public release of the code, details the calculations involved and discusses some insights made possible by the code's tunability. To demonstrate the package's ease of access, I also created all figures for the paper using Python.

Concrete description of what research was performed

Concrete description the outcome of the research

Quantifying the impact of this work

Further description of role in publication

In what type of environment do you and others thrive? How do you find, create, and maintain those environments? (300 words or less)

Throughout my experiences with research and coursework, I've come to realize the importance of fostering a friendly, supportive, and welcoming community. Having a healthy and diverse environment around you not only increases productivity but is essential in maintaining and improving mental health and overall wellbeing. During my undergraduate studies, I have been lucky enough to be a part of a positive environment, and it definitely played a role in getting me to where I am today. However, I have also recognized the need to contribute my own time and effort in maintaining it. To help support my community, I joined our campus's chapter of the American Institute of Chemical Engineers (AIChE). Just as I was entering the role of president in the spring of 2020, the COVID-19 pandemic began, and I saw the tight-knit, supporting environment around me deteriorate. The impact of this collapse could be seen as well, with students no longer being as motivated and energetic, especially for the incoming freshman class. To help alleviate

Directly answers first question

Directly answers second question

Provides concrete actions during a leadership position

Could have quantified these programs

this strain caused by COVID, I implemented a new mentoring program, pairing underclassmen with eager upperclassmen and providing them a link to the community. I also organized a series of town halls between students and faculty, focusing on topics ranging from graduate school to handling stress, and created a volunteer-based tutoring system. It was fulfilling to see the impact that these events had on our chemical engineering community, and they certainly made the pandemic a bit more bearable for everyone. I hope to serve in similar roles in the student-run support groups of MIT ChE, including DICE, GSC-X, and GSAB, helping to ensure the department is home to a diverse, accepting, and supportive community.

Connects back to MIT ChE

Please tell us anything else about yourself that you think we should know.

I make [redacted] as a hobby and post it on Twitter (@[redacted]