

My undergraduate career has presented me with opportunities to participate in relevant and exciting research projects, attend multiple international engineering conferences, and disseminate my work and findings formally and thoroughly. I have been involved in undergraduate research for the past three years, oftentimes undertaking multiple projects simultaneously.

I was first given the opportunity of working on a project in the area of ultra-high surface area materials via electrodeposition within humidity-controlled silica monoliths. The success of this project would usher, in addition to other capabilities, more effective forensic testing methods. My work as an undergraduate research assistant on this project, supervised by Professor Bakker in the chemistry department, sparked my interest in conducting research and my findings contributed to a publication in a peer-reviewed journal.<sup>1</sup> Following this experience, I was offered a position in the UA Microfabrication Facility (MFF). Since first entering the materials field of study, I found micro- and nano- scale features extremely interesting. I feel that materials at these small scales most clearly resonate the fundamentals of our field. The focus of my research in the MFF centered around improving the anti-reflective outer coatings for traditional solar cells through the top-down formation of closely spaced, high aspect ratio nanopillars. With the evident need for more efficient renewable energy sources, this project in solar energy collection captured my interests. In order to further the work on this project, I participated in an NSF-funded REU the summer after my sophomore year. Advancing to a Senior Research Assistant in the MFF while studying solar entrapment layers as well as the implementation of my silicon nanopillars in emerging graded media technologies, I was also privileged to extend the impact of my work outside of the laboratory by presenting results at six different venues including one Conference on Undergraduate Research and two international materials conferences.<sup>2,3</sup> My poster, entitled *Advanced Nanosphere Lithography for Novel Solar Absorber and Graded Media Technologies*, was one of five to receive recognition of the more than 900 students in attendance at MS&T.<sup>3</sup>

After immersion in research, I felt motivated to share my excitement and enthusiasm with others who may be stimulated by scientific innovations and engineering developments. With a grant from the American Chemical Society (ACS), I led an effort to organize a large-scale presentation of science and engineering innovations to the public. The result was an event titled *Science Café*, and involved a combination of five undergraduates, six graduate students, and four professors giving demonstrations of scientific principles at a local bookstore near campus. The discussions focused on fundamental materials concepts as well as new innovations in the field: particularly on the recent concentrations in nanotechnology. Through newspaper ads, fliers, and email announcements, we were able to attract more than 600 members of the community to *Science Café* including many students from local elementary, middle, and high schools.

A course in metal casting during my junior year sparked my interest in bulk production methods such as foundry sciences. Given the chance to work on an extracurricular project with my casting professor, I soon found ways of applying classroom concepts to meet industrial needs in a new and highly innovative manner through employment of three-dimensional modeling and mold printing. I presented my work at the American Foundry Society (AFS) regional meeting in conjunction with their annual Student Casting Competition, and received first place recognition

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<sup>1</sup> *The Journal of Physical Chemistry*: "Development of Ultrahigh Surface Area Porous Electrodes using Simultaneous and Sequential Meso- and Micro-structuring Methods"

<sup>2</sup> The Minerals, Metals, and Materials Society (TMS) Annual Meeting; San Diego, CA 2011

<sup>3</sup> The Materials Science and Technology (MS&T) Conference; Columbus, OH 2011

for my project and presentation.<sup>4</sup> After further refining the content of this new casting technique, I became the first to ever implement 3-dimensional modeling and mold-printing technology to cast a defect-free aluminum impeller. With that milestone in hand, I presented my casting work at two conferences.<sup>5,6</sup> For my oral presentation, entitled *Novel 3-Dimensional Printing Technology for Advanced Modeling and Casting of an A356 Impeller*, I was recognized as a finalist in the MS&T National Undergraduate Speaking Contest.

For my extracurricular work in emerging casting technologies, I was invited to speak to an introductory materials engineering course as a guest lecturer.<sup>7</sup> Following my presentation to introductory materials students, I delivered a guest lecture to a graduate-level class concerning my work in lithography and microfabrication from my experiences with the UA MFF.<sup>8</sup>

The final presentation of my work as an undergraduate came in the form of a written paper on my activities in casting research. A National Student Paper Contest for undergraduate and graduate students in the casting field was announced as a collaborative effort between the American Foundry Society and the Foundry Education Foundation during the spring of my senior year. I was urged to participate by Dr. Laurentiu Nastac, my former casting professor and research advisor for the casting modeling project. I submitted a paper entitled *Novel Three-Dimensional Modeling Technology for Advanced Simulation, Printing, and Casting of A356 Impeller*, which was awarded first place in the national contest. The AFS reviewing committee deemed my work to be innovative enough for publishing in their semi-annual peer-reviewed journal. My casting article is scheduled to be featured as the cover story of the winter 2012 edition of the *International Journal of MetalCasting (IJMC)*.

I believe that interdisciplinary research experiences in multiple departments and covering a range of topics from the nano- scale to bulk processing and production have prepared me well for a highly successful experience in graduate level research. Through my research involvement in the electrochemistry group, I became acquainted with healthy research practices such as keeping a proper lab notebook and thorough literature reviews. My experience in solar energy collection in the Microfabrication Facility introduced me to vacuum systems in a cleanroom environment. The long-term solar project in the MFF also gave me ample opportunity to disseminate my findings at professional venues. Research in pre-cast modeling has taught me the significant contributions of simulation on final product characteristics and defect minimization. Through sharing these experiences with other students on campus, as well as with members of the community, I have hoped to enliven future students to pursue scientific innovation with an open mind and willingness to work. My sincere desire is that the broader impacts of events such as *Science Café* and guest lectures serve to stimulate and excite the scientists of tomorrow.

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<sup>4</sup> Oral Presentation entitled *A356 Impeller: A Prototype Part Cast in Silica Sand with Furan Mold*. Birmingham, AL; April, 2011

<sup>5</sup> Oral Presentation, Materials Science and Technology Conference; Columbus, OH 2011

<sup>6</sup> Poster Presentation, The Minerals, Metals, and Materials Society Annual Meeting; Orlando, FL 2012

<sup>7</sup> Guest Lecturer for MTE 101 "Introduction to Materials" course, Fall, 2011

<sup>8</sup> Guest Lecturer for MTE 550 "Plasma Processing in Vacuum Systems" course, Fall 2011