Student jobs that sparkle at Fraunhofer USA

Student employment is a great source of income during a student’s college years, and an even better way to explore careers and build professional networks.

Electrical and computer engineering PhD student Matthias Muehle and chemical engineering senior Mary Ensch are student employees of Fraunhofer USA, and both have challenging roles in the MSU-Fraunhofer Center for Coatings and Diamond Technologies (CCD).

Thomas Schuelke, executive director of the MSU-Fraunhofer CCD and an MSU professor of electrical and computer engineering, said the students benefit from the partnership between MSU and one of Europe’s largest applied research organizations.

“MSU and Fraunhofer provide each other with unrivaled knowledge, experience, and resources – and a unique opportunity for their students,” Schuelke explained. “Our student employees are able to gain real industrial project
experience while continuing to further academic research. The collaborations between top scientific institutions and industry leading companies act as a bridge to scientific progress and economic development.

“Students get to see firsthand how Fraunhofer executes R&D projects for its industrial partners. These projects look to advance existing knowledge and technology in regards to thin film vapor deposition techniques and efficient synthesis methods for diamonds,” he added.

**Q & A with Mary Ensch**
Mary Ensch, a senior in chemical engineering, cleans and analyzes diamond samples for her student job. She is from Belleville, Mich. At MSU, she is a mentor for Women In Engineering and a member of MSU’s chapters of the Society of Women Engineers and the American Institute of Chemical Engineers.

**What do you do at Fraunhofer?** I assist in laboratory work by cleaning and analyzing diamond samples. I am also in the process of implementing a reflux condenser system in the acid fume hood to collect acid vapors.

**What are your career goals?** I plan to go straight into industry when I graduate. I am not sure where I would like to be yet, but I know that I enjoy being in a lab setting. Ultimately, I would like to be working with something that will directly benefit consumers and the environment.

**How does an MSU degree benefit to your career?** I not only learn the concepts that I will be using when I enter industry, I have had the opportunity to apply them through lab and design classes. The degree program is very well rounded in the technical and ethical classes it includes, and the experience of working with teams. MSU’s chemical engineering department is ABET accredited, which gives employers comfort in knowing we have been set to a higher standard of learning. In order for me to benefit the lives of others, or the health of the Earth, I need to have the education that will allow me to do so. My degree will grant me access to an industry where I can work to reach these goals.

**What has been your favorite part of your MSU experience?** Even though MSU is such a large university there is a great sense of community between everyone. I also really enjoy going to the home football games.

**How are undergraduates helpful to Fraunhofer?** Undergraduates bring fresh ideas that they are currently learning in the classroom.
fall 2012. He is from Görlitz, the most eastern city in Germany, located 65 miles east of Dresden in Saxony. Since World War II, Görlitz is a divided city – the Western being German, while the Eastern part is Polish.

**Where did you get your bachelor’s degree?** I received my college education at Technische Universität Dresden (Dresden University of Technology). I went to college before the Bologna Declaration was in action. The process standardized academic degrees (bachelor and master). I enrolled in the old German system: a five-year program consisting of four years course work and a one-year final research thesis (which I wrote here on campus at Fraunhofer). Afterwards I received my “Diplom” in physics. The degree is equal to a master’s degree, and I was treated like that when I joined MSU.

**What do you do at Fraunhofer?** I have been a project engineer at Fraunhofer since 2012. I execute projects, including machine maintenance, executing experiments, post analysis, and project reporting.

My PhD thesis research focuses on technology development in order to synthesize two-inch single crystalline diamond wafers. As of now technology is limited to about 10 x 10 mm² in size. The problem I am working on is really multi-dimensional as you have to tackle several issues at the same time such as: (i) how to actually increase the lateral crystal dimensions or (ii) how to separate grown material efficiently (diamond is the hardest material known, so we cannot mechanically saw it like silicon) just to name a few. Several official projects have been established with Fraunhofer working on specific problems my thesis addresses. This ensures, that I can finish my PhD thesis in a timely manner. It involves more official reporting, but opens up plenty of new opportunities. For example, we identified that using ion beam irradiation before diamond synthesis would be an efficient way to separate the grown diamond from the seed crystal. I identified a perfect facility in the Department of Physics at Western Michigan University. Through Fraunhofer, I established a collaboration with the group at WMU. We are making great progress, have already showed feasibility of the process, and are currently planning on how to optimize the procedure. I presented recent results when attending this year’s New Diamond and New Carbons conference in Shizuoka, Japan, and won the best student poster award.

Besides my thesis research, I am involved in really interesting side projects. In collaboration with an industrial partner (Mackinac Technology Company), we are developing an antireflective coating for bus windshields. Back reflections of the light in the passenger compartment during night times severely reduce the driver’s vision. The Department of Transportation identified this as the number one cause for lethal accidents with pedestrians.
Being part of this project gives me new insights on different technologies. It really broadens my horizon because the work is completely different than my diamond research. I have also learned a lot about thin coatings. Knowing that our solution will be implemented within the next years makes me proud. While a lot of PhD research has the potential to change things in say 20 years, our solution will change individuals lives as soon as in a year. (http://www.egr.msu.edu/fraunhofer-ccd/projects/anti-reflective-coatings-transit-bus-windshields)

Additionally, I am involved in supervising students. Fraunhofer CCD has several undergraduate interns from MSU and international institutions. They work alongside the staff to support the project execution. Several of the international interns came to Fraunhofer CCD to write their master’s thesis. I already had the chance to successfully supervise one thesis in physics and just started supervising another one. You transform from the typical learning role as a student and are passing your knowledge to someone else moving you into the educator’s role.

What are your career goals? I am still torn if I want to be a full time researcher or pursue a faculty position. I really love my research, but nothing is more satisfying than seeing the happiness when someone learned something. Knowing that you are the person passing the knowledge to others, who are eager to learn, makes me feel accomplished.

What has been your favorite part of your graduate experience? It may not count as specific graduate experience: The most impressive part at MSU is the entire school spirit. Everyone at MSU, faculty, staff and students, associate themselves with the university. You can talk with alumni and they will tell you why MSU was the right choice back in the 1970s and they are still proud of it. Growing into this spirit really changed my perception on university. In Germany you usually do not have a bond with the university you are attending. One of the big reasons I enjoy my graduate program at MSU is the feeling of being an integral part of something. I always value the opportunity MSU gave me, and I work hard to give back. And whenever someone asks me about my college affiliation I proudly answer Michigan State University – mentioning Dresden did not spark my mind, not even once.

How are graduate students helpful to Fraunhofer? Being a graduate student at Fraunhofer is a win-win situation. One great example of how Fraunhofer benefits from graduate students is the ion implantation project. In the early stage of a different project, I identified that having a different separation technique for diamonds would be really beneficial. We have already made great progress -- this particular step is essential for the fabrication of large diamond wafers. Chances are, the issue may not have been investigated yet without me pointing on it.

Muehle academic achievements
10/12 – 09/13
Supervision of MSc thesis “Doping of epitaxial diamond films grown by plasma CVD” by Svenja Bachmann at University of Duisburg-Essen in Physics

10/13
Established a research collaboration with University of Duisburg-Essen Department of Physics, AG Buck

06/14
Established a research collaboration with Western Michigan University, Department of Physics, Van de Graaff Accelerator Facility

02/15
Invited Panelist in “Careers in Nonprofits & Government for STEM PhDs” at Expanded Careers Event hosted by Michigan State University, Graduate School

05/15
Best Student Poster award for my presentation “Single crystal diamond irradiation for lift-off processes using proton and carbon beams” at New Diamond and New Carbons (NDNC) conference in Shizuoka, Japan (International Conference)

09/15
Awarded with COGS conference grant to attend Materials Research Society (MRS) Fall Meeting

11/15
Second Best Poster award for my presentation “Enhancing the safe and efficient high pressure microwave plasma assisted CVD operating regime for SCD synthesis using continuous wave and pulsed microwave excitation” in Symposium DD at Materials Research Society (MRS) Fall Meeting in Boston (International Conference)

11/15 – 06/16
Supervision of MEng thesis by Theresa Sperk at University of Applied Sciences in Zwickau in Nanotechnology. The goal is to design and set up a measurement station for birefringence in single crystalline diamonds. The thesis title is not defined yet.

Related Website: Fraunhofer Center For Coatings and Diamond Technologies
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