FuSe Internship

CNF Project Number: CNF Summer Internship
Principal Investigator(s): Ron Olson[1], Lynn Rathbun[1]
User(s): Sherri Ellis[2]

Affiliation(s): 1. Cornell NanoScale Science & Technology Facility (CNF), Cornell University; 2. Engineering Program, Tompkins Cortland Community College

Primary Source(s) of Research Funding: Cornell NanoScale Science & Technology Facility (CNF), a member of the National Nanotechnology Coordinated Infrastructure NNCI), which is supported by the National Science Foundation (Grant NNCI-2025233)

Contact: olson@cnf.cornell.edu, rathbun@cnf.cornell.edu, see43@cornell.edu

Research Group Website: https://www.cnf.cornell.edu/

Primary CNF Tools Used: Hamatech Hot Piranha & Wafer Processers, YES EcoClean Asher, SÜSS Microtec Gamma Cluster System, Heidelberg DWL 2000 Mask Writer, ABM Contact Mask Aligner, ASML PAS 5500/300C DUV Wafer Stepper, Oxford 1000 Plasma Enhanced Chemical Vapor Deposition (PECVD) System, FilMetrics F50, Zeiss Scanning Electron Microscopes (SEMs), Veeco Icon Atomic Force Microscope (AFM).

Abstract:

I am participating in the Future of Semiconductors (FuSe) internship, a new collaboration between the Cornell Nanoscale Facility (CNF), Tompkins Cortland Community College (TC3), the University of Chicago and the University of Wisconsin-Madison. This internship includes learning about micro and nano fabrication, using CNF's cleanroom tools and processes, assisting with tasks in the photolithography areas, and providing support to a research project focused on new resist polymers. I have completed seven weeks of the 16-week internship.

Summary of Research:

I began with learning about cleanroom tools through CULearn's online courses and participating in CNF's short course "Technology & Characterization at the Nanoscale." This was followed by hands-on training and practice with some of CNF's cleanroom tools and assisting with daily and weekly tasks in the photolithography areas.

The processes and tools that I have been trained in and utilized include the following: For cleaning wafers, I used the hot strip bath, spin rinse dryers, Hamatech Hot Piranha, YES EcoClean Asher, and Glen 1000. For applying wafer coating by hand, I used spinners, hotplates, and the FilMetrics F50 to measure the photoresist film thickness. For automated wafer coating and post exposure developing, I ran the SUSS Microtec Gamma Cluster System.

For making masks, I learned how to use KLayout / L-edit CAD software to create the design, and the Heidelberg DWL 2000 Mask Writer to create the masks. To expose the coated wafers with a mask, I operated the ABM Contact Mask Aligner (figure 1) and the ASML PAS 5500/300C DUV Wafer Stepper. For developing the photoresist after exposure, I used the Hamatech Wafer Processors. I was also trained on the Oxford 1000 Plasma Enhanced Chemical Vapor Deposition (PECVD) system for thin film deposition.

For microscopy, I have operated basic optical microscopes, Zeiss Scanning Electron Microscopes (SEMs) (figure 2), and the Veeco Icon Atomic Force Microscope (AFM). I may also still receive training on the JEOL 6300 Electron Beam Lithography System.

I was offered the opportunity to prepare wafers for use in training, using a specific recipe through a multistep process. Some of the wafers were previously used, so I first cleaned them by spinning with acetone/IPA, using the hot strip bath, the spin rinse dryer, the Ecoclean, and the Hot Piranha. Once prepared, I coated the wafers on a spinner, baked them, assessed thickness with FilMetrics F50, exposed them using the ABM Contact Aligner, developed them in a Hamatech, and completed the process with a hard bake. I appreciated being able to engage in a multistep photolithography process in service of a useful finished product.

Regarding assisting with daily and weekly tasks in the photolithography rooms, this included cleaning, refilling and restocking chemicals and supplies, refilling

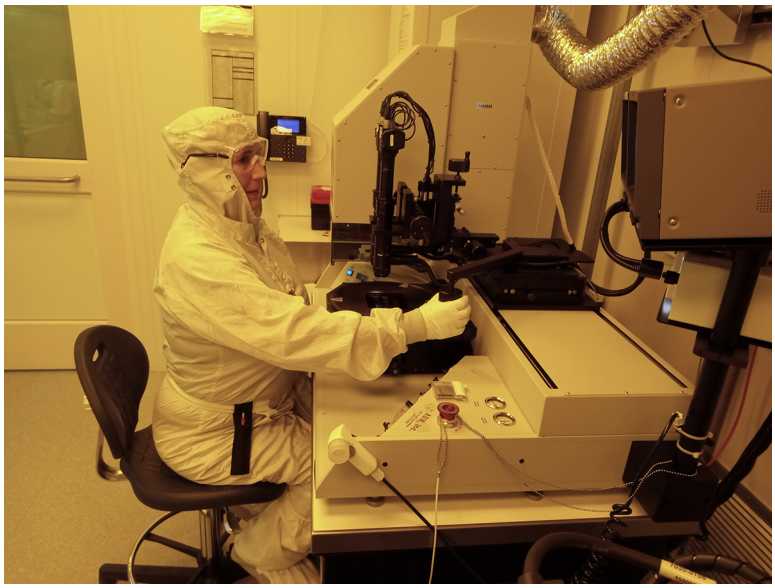

Figure 1: Ellis at the ABM Contact Mask Aligner.

Figure 2: Ellis at the Zeiss Scanning Electron Microscope (SEM).

chemicals in the Hamatechs and Hot Piranha, and refilling water in the Gamma, ASML, and DWL 2000.

For the second half of my internship, I will continue to help with tasks in the photolithography areas and assist a Ph.D. student with research focused on developing a new resist polymer. Per the student, the project "focuses on using a block copolymer with an ideally high χ (chi) value to improve etching contrast, applying directed self-assembly as a strategy to increase pattern density."

This internship has been a valuable learning experience so far. I am so grateful for this opportunity to learn about photolithography processes and tools, and to have so many hands-on experiences in the cleanroom. I'm looking forward to further training, continuing to assist in the photolithography areas, and participating in the innovative research project.

Acknowledgements:

Special thanks to the following CNF staff for their supervision, training, and support: Ron Olson, Garry Bordonaro, Giovanni Sartorello, John Treichler, Xinwei Wu, Aaron Windsor, Jeremy Clark, and Alan Bleier, and to Ph.D. student Chaoqiuyu (Rachel) Wang for the opportunity to assist in her research.