Providing Opportunities for Undergraduate Students: *Micro-Fabrication Techniques*

Micro- and nanofabrication techniques underpin the production of devices ranging from the processor in our computer, to integrated photonic circuits, to lab-on-a-chip devices for biological sensing applications. However, it is difficult, costly, and time consuming to teach these skills to undergraduate students. Professor Amr Helmy from The Edward S. Rogers Senior Department of Electrical and Computer Engineering has used the Open Research Facility clean rooms to host five undergraduate design projects.

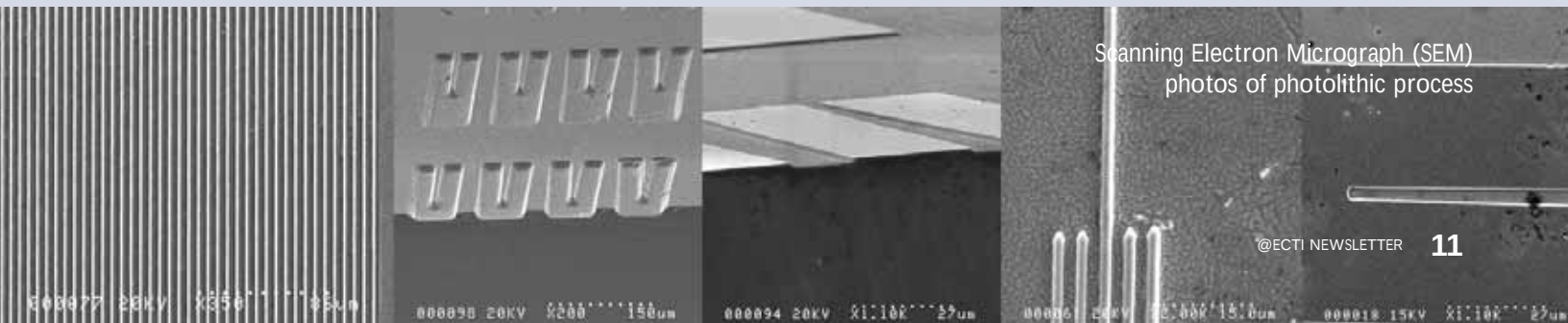
Researcher working at the fume hood of the ECTI Cleanroom

Each project involved a team of two students who investigated a particular aspect of the microfabrication process. Students were introduced to all aspects of the photolithographic process, including resist spinning, pattern transfer and etching. During each project students used these skills to develop and refine a particular step of the process. For example, one of the teams was able to refine the photolithographic process to produce features down to ~ 1 micron, which were suitable for the production of integrated optical circuits, as shown on the scanning electron micrograph. In order to achieve this combination of quality and process uniformity, students had top optimize parameters such as spinning speed, exposure time, and development process.

The results from these undergraduate projects will help many of the graduate research projects currently using the clean room. The availability of well-characterized fabrication protocols will allow researchers to rapidly prototype new concepts.

This case study demonstrates the synergy of how undergraduate teaching can benefit from access to a state-of-the-art clean room facility, while at the same time graduate research is aided by the involvement of undergraduate project students. In addition, such use of the ORF provides the first steps in developing a curriculum for giving undergraduate students hands-on experience with microfabrication techniques.

For further information, please contact Professor Helmy, a.helmy@utoronto.ca. ■



Scanning Electron Micrograph (SEM) photos of photolithic process