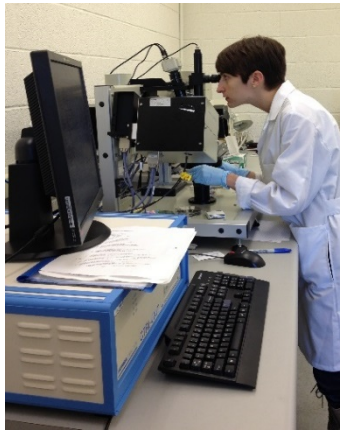


Materials for Opto/Electronics Research and Education (MORE) Center



The Materials for Opto/Electronics Research and Education (MORE) Center provides industrial and academic users with direct and service based access to specialized equipment that enables the fabrication and characterization of cutting edge materials and devices related to solar energy and emerging electronic and optoelectronic technologies. In addition to the assistance of expert faculty and staff, the MORE Center houses state-of-the-art facilities, including cleanroom and glovebox facilities to allow for research in clean and inert environments; an array of thin film characterization tools to probe thin film morphology and optical properties; and a wide range of deposition tools that can perform sensitive and challenging material application operations. The MORE Center is a collaborative environment where students, faculty, and industry leaders can develop the kind of innovative technology that will shape the future.

EQUIPMENT LIST

POLYMER PHOTOVOLTAIC FACILITY 25-FOOT N₂ GLOVEBOX SUITE WITH:

- Laurel Technology WS-400 spin coater, hot plates and vacuum oven
- Integrated Angstrom Engineering physical vapor deposition chamber, with e-beam, sputter and thermal evaporators
- Characterization in the inert N₂ environment, including solar simulator and IV station, PV quantum efficiency measurements and probe station for FET measurements

DEPOSITION

- UV-ozone cleaner with substrate heating
- Plasma cleaner and reactive ion etcher
- Evovac deposition system with 5 sources; 2 resistive sources, 2 sputter sources and an electron beam source
- Spin coater with fragment adapter
- Rapid thermal annealer

CHARACTERIZATION

- Stylus profilometer, KLA-Tencor P-6
- Optical profilometer, Zygo NewView 7300
- Nanovea optical profilometer, ST400
- Nanovea PB1000 microindenter, with wear and scratch options
- UV-Vis spectrophotometer, Ocean Optics
- Spectrofluorometer with quantum yield accessory, Horiba Fluorolog 3
- Optical microscope, Leica DM2500M
- Contact angle goniometer
- Device characterization: solar cells (Oriel SOL 2A solar simulator & IV station, PV Measurements QEX10 quantum efficiency measurements), transistors (Micromanipulator 450PM-B probe station with Keithley 2636B) and LEDs (IV and integrating sphere for emission)

PHOTO AND ELECTRON BEAM LITHOGRAPHY

- Scanning electron microscope (SEM) for e-beam lithography
- Class 10000 clean room with Laurell WS-400 spin coater and Karl Suss MJB3 mask aligner

CONTACT INFORMATION

WEBSITE

phys.cwru.edu/sites/morecenter/

EQUIPMENT

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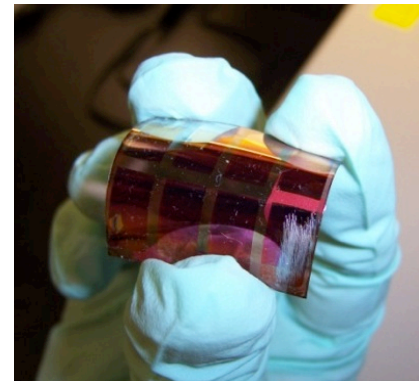
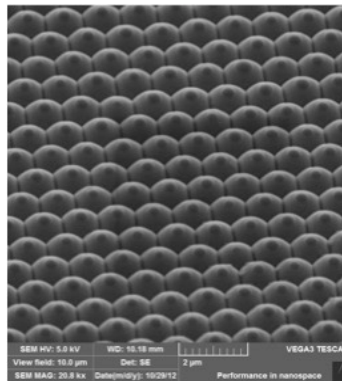
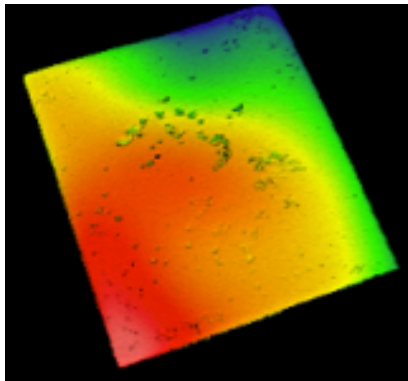
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SUCCESS STORIES

Using the MORE Center as R&D Lab Space

Numerous external users have come to the Materials for Opto/Electronics Research and Education (MORE) Center facilities for assistance with their product development. From transnational corporations to local startups, users are able to access an array of tools and processes, as well as obtain training to create and measure their own samples. External academic users have similar opportunities, and the Center has capabilities that range from measuring single samples to running full research projects. Users have taken particular advantage of the Center's thin film deposition and characterization processes. The high throughput characterization techniques allow for non-destructive measurements of film thickness, roughness, and optical properties, all at atmospheric pressure. In addition to the facilities, the MORE Center staff has extraordinary expertise on thin films and optoelectronic devices that is available to any and all users. This combination of world-class facilities and expert knowledge has made the MORE Center a unique and unparalleled resource for product research and design.



Experiential Learning at the MORE Center

Since its inception in 2011, the MORE Center has provided a maker space for over 250 students, from high-school students working on their first projects to graduate students collecting the final piece of data for their dissertations. The 25 state-of-the-art deposition and analytical tools, glovebox and cleanroom spaces, and array of potential processes to experiment with have served CWRU students from Arts & Sciences, Engineering, and the School of Medicine. Universities from across the state of Ohio, including Kent State University and the University of Akron, have also benefited from access to the singular opportunities available at the MORE Center. Training and help with process development is available for an assortment of optoelectronic and electronic materials as well as device fabrication and characterization. Additionally, the MORE Center has worked with other centers across campus to pioneer short courses and pop-up classes to supplement formal course work at CWRU, with topics ranging from Photovoltaics 101 to hands on practice of proper soldering techniques.