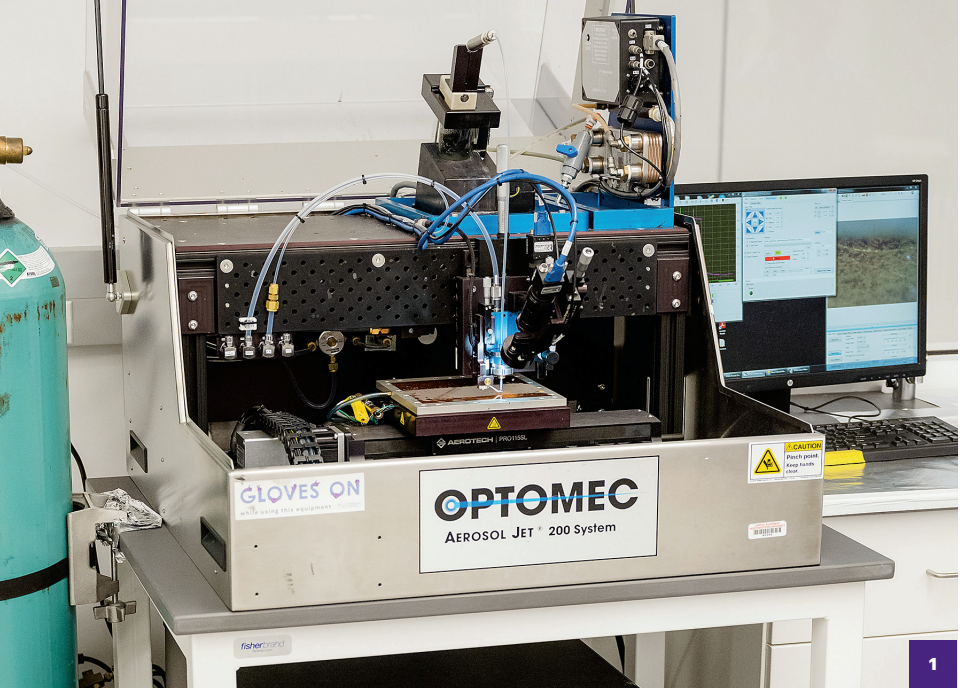

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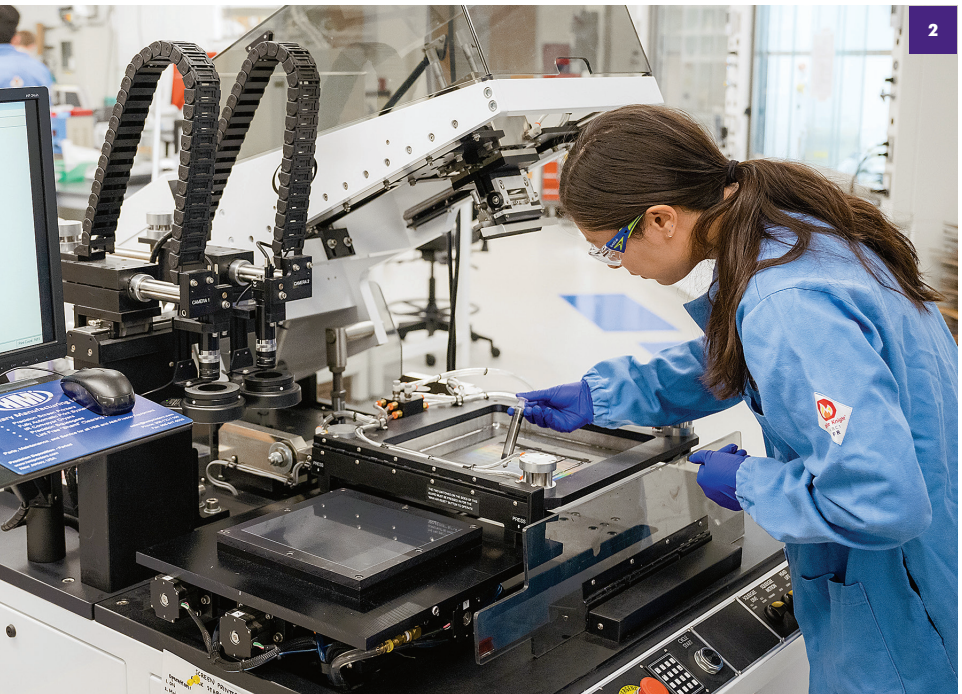
LAB TOUR
MATERIALS INNOVATION LABORATORY



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Thinking big about small materials, researchers in Northwestern Engineering's Materials Innovation Lab are advancing additive manufacturing at the nanoscale, developing methods to produce sustainable materials and inks that will help build the biosensors, batteries, transistors, and neuromorphic devices of the future.

"The applications for these devices and materials address some of the most significant challenges and opportunities confronting society, from sustainability to next-generation computing to healthcare innovation," says Mark Hersam, Walter P. Murphy Professor of Materials Science and Engineering and chair of the Department of Materials Science and Engineering. "The work done by our students in the Materials Innovation Lab directly reinforces Northwestern Engineering's leadership in materials science."

Located on the fourth floor of Mudd Hall, the Materials Innovation Lab opened in fall 2023 and includes an array of advanced printing and battery testing technologies.

1. OPTOMEC AEROSOL-JET PRINTER
This aerosol-jet printer aerosolizes functional nanomaterial inks and deposits them onto a substrate using a carrier gas. This contactless, digitally programmable technique enables high-resolution patterning of a wide range of nanomaterials onto an array of surfaces, making it a valuable prototyping tool for printed electronics.

2. AUTOMATED SCREEN PRINTER This automated screen printer helps researchers print thin and flexible electronic devices, including batteries and sensors. Similar to the process used to screen-print T-shirts, the printer deposits and presses different electronic materials through a stencil to build devices layer by layer. This instrument is key to the lab's efforts to scale up its production to larger quantities, as it offers rapid printing speeds, large-area coverage, and high resolution.

Tour the Materials Innovation Lab
View the lab's devices in action and learn from students how these technologies support research.

Photos by Jason Brown

3. METAL-ORGANIC CHEMICAL VAPOR DEPOSITION Metal-Organic Chemical Vapor Deposition (MOCVD) is a workhorse system for growing monolayer atomically thin films, specifically semiconducting, wafer-scale materials used in neuromorphic computing and quantum information science. Capable of reaching 1,100 degrees Celsius, MOCVD functions as a high-temperature, controlled-atmosphere oven.

The MOCVD variables can be tuned precisely to create a chemical environment that ensures that the atomically thin films grown in the lab possess desirable crystallinity and electronic properties. Stephanie Liu, a PhD student in the Hersam lab, says, "Ultimately, we want to know—can we still create great quality films at lower temperatures that use less energy?"

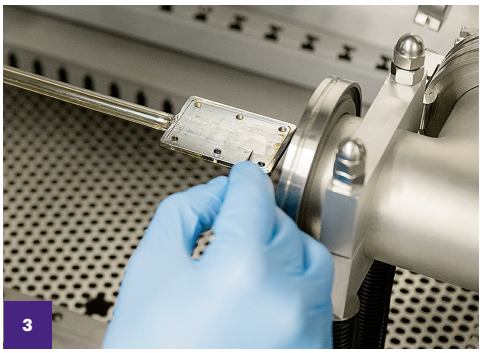
4. BATTERY MEASUREMENT STATION The lab's battery cycler is used to continuously charge and discharge prototype batteries that could eventually be used in applications such as powering electric vehicles or supporting the electrical grid. The system measures the longevity of the lab's electrodes and electrolytes that utilize nanoscale composite materials. While some tests are completed within a few hours, other tests focused on long-term performance can take several months. Optimizing electrochemical energy storage, especially in batteries, is a critical component in the transition away from a fossil-fuel-based economy.

5. FUJIFILM DIMATIX MATERIALS PRINTER This inkjet printer supports research and development as well as feasibility testing by transforming digital designs into physical prototypes. It seamlessly and precisely deposits ink droplets onto surfaces found in flexible electronics, optoelectronics, and sensors.

When used in tandem, the lab's three printers can print material layers at different length scales to build complex devices.

ALEX GERAGE

3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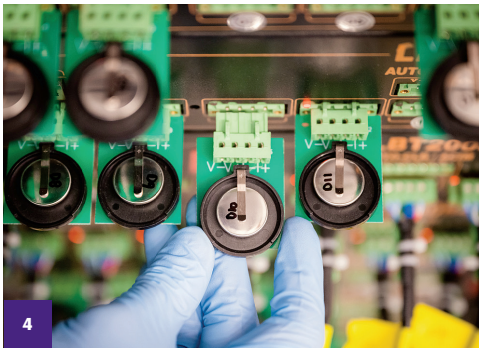
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