



Guest Lecture
**Columbia University Electrical
Engineering Department**

Professor William Scheideler

***Thayer School of Engineering,
Dartmouth College***

Date: Thursday, Jan. 16

Time: 11:00am-12:00pm

Location: EE Conference Room

Title: Scalable Nanomanufacturing
for Next Generation Electronics
and Energy Devices

Guest Lecture

Scalable Nanomanufacturing for Next Generation Electronics and Energy Devices

Emerging energy and electronics technologies such as lightweight solar cells, low power computing devices, and earth-abundant water splitting could help power the renewable energy transition, but their impact is limited by their performance and manufacturability. Here we pose that *scalable nanomanufacturing* via printing could address these needs by allowing low-cost integration of high-performance materials over large areas and in new 3D geometries. We apply printing to three challenges in scalable fabrication: 1) How to print high performance ultrathin semiconductors, 2) How to design inks for printing large area solar cells, and 3) how to print 3D electrodes for energy devices. We first focus on an emerging class of two-dimensional (2D) metal oxide semiconductors printed via roll-based Cabrera Mott surface oxidation of liquid metals. We discuss the engineering of heterostructures of 2D oxides as degenerate TCOs and as semiconducting channels for transparent transistors and we examine the impact of quantum confinement on their optoelectronic properties towards applications in large area electronics. We next investigate the physics of roll-based flexography of metal halide perovskite solar cells, showing the fluid mechanics that enables large-area patterning at state-of-the-art uniformity to enhance device performance and stability. Finally, we consider fabrication of 3D-printed metal oxide microlattices for gas sensing and electrocatalysis, showing how graph-theory and additive manufacturing can boost efficiency and enhance 3D mass-transport.

About Professor William Scheideler

Prof. William Scheideler graduated summa cum laude from Duke University in 2013 with B.S.E. degrees in Electrical Engineering and in Biomedical Engineering. He completed his Ph.D. as an NSF Graduate Research Fellow in Electrical Engineering at the University of California, Berkeley, where his doctoral thesis explored scalable nanomanufacturing of metal oxide electronics.

He completed his postdoctoral studies in Materials Science and Engineering at Stanford University, where he studied scalable fabrication and thermomechanical reliability of perovskite solar cells. Will joined the faculty of Dartmouth College's Thayer School of Engineering as an Assistant Professor in 2019, launching the SENSE (Scalable Energy and Nanomaterial Electronics) Laboratory. His research interests include 3-D nanomanufacturing and 2D materials for electronics and energy applications. In 2023, William was a recipient of the SME's Delcie Durham Outstanding Young Manufacturing Engineer Award recognizing his research in advanced electronics manufacturing.