

THE MATERIALS SCIENCE AND ENGINEERING DEPARTMENT
SPRING 2026 COLLOQUIUM SERIES PRESENTS:

Professor Matthew McDowell

Professor and the Carter N. Paden Jr. Distinguished Chair for Innovation
in Materials Science and Metals Processing

Georgia Institute of Technology



Interfaces and Chemo-Mechanics in Solid-State Batteries

Advancing battery technology requires more than the discovery and synthesis of new materials – it demands a deep understanding of how these materials behave and degrade under real-world operating conditions. Here, I will introduce my research group's recent work focused on understanding interfaces and chemo-mechanics within solid-state batteries. Solid-state batteries are a rapidly developing technology that could feature higher energy density and improved safety compared to lithium-ion batteries. However, the presence of solid-solid electrochemical interfaces, rather than conventional liquid-solid interfaces, causes different fundamental phenomena to govern behavior. I will discuss my group's work on investigating lithium metal anodes and alloy anodes for solid-state batteries, the mechanisms by which interfaces evolve when using these materials, and how we have pursued new metallurgical and chemo-mechanical designs to improve performance. I will also introduce our other energy storage innovations, including a new reversible electrochemical engine concept for ultrahigh energy density. In all these examples, our understanding of material behavior has enabled the engineering of materials for enhanced performance and longevity, highlighting the importance of the characterization-materials design feedback loop for battery innovation.

Matthew McDowell is a Professor and the Carter N. Paden, Jr. Distinguished Chair for Innovation in Materials Science and Metals Processing at Georgia Tech, with appointments in the Woodruff School of Mechanical Engineering and the School of Materials Science and Engineering. His research is focused on understanding and engineering materials for energy storage. He is the Co-Director of the Georgia Tech Advanced Battery Center (GTABC) and is an Associate Editor of the peer-reviewed journal *ACS Nano*. McDowell has received numerous awards, including the Presidential Early Career Award for Scientists and Engineers (PECASE), Sloan Fellowship, the ECS Battery Division Early Career Award, and he was a Blavatnik National Award Finalist in 2025.

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In person only; no Zoom

Questions? Contact allison.macknick@northwestern.edu