

Spring 2023 Joint Colloquium

Materials Department & Materials Research Laboratory

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Department of Chemical
Engineering

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11:00 am | ESB 1001



Tracking Degradation in Commercial Li Batteries with High Chemical and Temporal Resolution

Although Li metal anodes offer the highest possible specific energy density for Li-based batteries, their application is plagued by the growth of high surface area Li deposits. The presence of these Li filaments is correlated with the formation of dead (electrochemically inactive) Li that leads to low Coulombic efficiency (CE) and serious safety concerns due to short-circuiting. Li filament growth is strongly coupled to the composition and the spatial arrangement of the solid electrolyte interphase (SEI) that forms during contact with a liquid electrolyte and continues to evolve over the course of electrochemical cycling. In a practical battery, the properties of the SEI layer can be altered by decomposition products formed at the cathode and thus, understanding degradation across the entire cell is critical to understanding performance. In this talk, I will discuss our efforts to use *operando* nuclear magnetic resonance (NMR) spectroscopy to probe interfacial instabilities in these systems and quantitatively detect Li microstructural growth, dead Li formation, and electrode/electrolyte decomposition to determine the precise mechanisms of failure in realistic Li battery materials, including commercially-available multilayer pouch cells.

Bio

Lauren Marbella is an Associate Professor in the Department of Chemical Engineering at Columbia University. Her research group focuses on understanding the relationship between electrochemical performance and interfacial chemistry in devices for energy storage and conversion. Her research relies heavily on the use of nuclear magnetic resonance imaging (MRI) and spectroscopy to evaluate changes in material properties in real time to elucidate the chemical mechanisms underpinning degradation in Li and beyond Li-ion battery systems. Marbella's research has received numerous awards including the ACS *Materials Au* Rising Stars in Materials Research Award (2022), Cottrell Scholar Award (2022), the National Science Foundation (NSF) Faculty Early Career Development (CAREER) Award (2021), and the Scialog Collaborative Innovation Award for Advanced Energy Storage (Sloan Foundation, 2019).

She received her PhD in chemistry from the University of Pittsburgh in 2016, under the direction of Prof. Jill Millstone. In 2017, she was named a Marie Curie Postdoctoral Fellow at the University of Cambridge in the group of Prof. Clare Grey. There, she was also named the Charles and Katharine Darwin Research Fellow, which recognizes the top junior fellow at Darwin College at the University of Cambridge. She joined the chemical engineering faculty at Columbia University in 2018.

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