NORTHWESTERN UNIVERSITY'S DEPARTMENT OF MATERIALS SCIENCE AND ENGINEERING AND MATERIALS RESEARCH SCIENCE AND ENGINEERING CENTER PRESENT:

2022 MSE FUTURE LEADERS SEMINAR SERIES

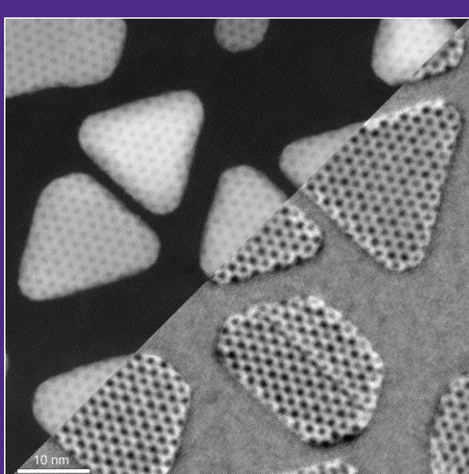
Kate Reidy

PhD candidate and MITei Fellow, Massachusetts Institute of Technology

Kate Reidy is currently a PhD candidate and MITei Fellow in Materials Science & Engineering at Massachusetts Institute of Technology, working under the guidance of Prof. Frances M. Ross. She received her B.Sc in Nanoscience, Physics, and Chemistry of Advanced Materials from Trinity College Dublin (Ireland). Her research takes a 'bottom up' approach towards nanoscale design, tailoring material properties by understanding and manipulating their atomic structure. She develops ultra-high vacuum and environmental in-situ transmission electron microscopy (UHV-TEM and ETEM) methods which provide high spatial and temporal resolution to elucidate kinetic growth mechanisms, chemical composition, and response to stimuli at the atomic scale. Her work has been recognized by the MIT School of Engineering William Asbjornsen Albert Fellowship, MIT Energy Initiative Fellowship, MathWorks Engineering Fellowship, and the MIT Lemelson-Vest Award for Student Innovation. Outside of lab, she acts as representative on the Departmental Committee of Graduate Studies (DCGS) at MIT, helping to re-design the graduate core curriculum, and on the board of MIT Women and Gender Minorities in Materials Science (WXOMS).

Atomic-scale design of the 2D/3D interface

Well-controlled nanostructures and their interfaces with surrounding materials are at the core of our most advanced technologies, from superconducting qubits to emerging catalysts. In particular, 3D metal integration with 2D van der Waals materials (2D/3D interfacing) is routinely required for the fabrication of nanoscale devices. However, nanometer-scale spatial fluctuations in the local 2D/3D interface structure directly affects properties and limits widespread application. In this seminar, I will map the local structure-property relationships at the 2D/3D interface using a combination of *in-situ* ultra-high vacuum (UHV) TEM, atomic resolution scanning transmission electron microscopy (STEM), and monochromated high-energy resolution electron energy-loss spectroscopy (EELS). First, I will show how the unique structures at the 2D/3D interface grown in UHV lead to epitaxial, faceted nanoscale islands with ultra-low defect density interfaces. Then, I will discuss the key parameters of 2D/3D growth, including the role of temperature, defects, moiré, surface chemistry, and thermodynamic equilibrium shapes. Lastly, I will describe how the 2D/3D interface structure influences local electronic and excitonic properties. Such understanding of the structure-property-performance relationship allows versatile design of 2D/3D heterostructures for next generation nanoscale devices.



Tuesday, June 14 • 10 AM CDT • Zoom Link

Meeting ID: 958 6172 3631 • Password: mse_FLS

Questions? Contact Elena.Lindstrom@northwestern.edu

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