Speaker 1: Professor Eric Stach

Robert D. Bent Professor of Engineering in the Department of Materials Science and Engineering at the University of Pennsylvania

Title: Electron and ion microscopy at the Singh Center for Nanotechnology at Penn

Abstract: The capabilities for focused-ion beam and transmission electron microscopy at the Singh Center for Nanotechnology at Penn have dramatically improved in the last five years due to institutional and government-funded investments (NSF). In this presentation, I will review these capabilities, using examples from research activity in my group and other groups at Penn, the surrounding region, and beyond. I hope to provide insight into how members of the Philadelphia Microscopy community can utilize the resources to advance their own scientific goals and will explicitly describe how to access the facilities.

Biography: Eric Stach is the Robert D. Bent Professor of Engineering in the Department of Materials Science and Engineering at the University of Pennsylvania. Before his appointment at Penn, he held several positions, including Electron Microscopy Group Leader at the Center for Functional Nanomaterials, Brookhaven National Laboratory, Professor at Purdue University, and Staff Scientist and Principal Investigator at the National Center for Electron Microscopy, Lawrence Berkeley National Laboratory. He is also a co-founder and Chief Technology Officer of Hummingbird Scientific, a nanotechnology company that enables advanced experimentation for electron, ion, and x-ray microscopies. His research interests focus on developing and applying real-time characterization approaches to solve a wide range of materials problems, with the most recent emphasis on catalysis, energy storage materials, and nanostructure growth.

Speaker 2: Brittany Cymes, Ph.D.

NRC Postdoctoral Research Fellow (since July 2020)
Materials Science and Technology Division
U.S. Naval Research Laboratory, Washington, D.C.

Talk Title: “Analyzing Space Weathering Features of Lunar Soils with STEM-EELS and EDS”

Abstract: Space weathering refers to physical and chemical changes occurring on the surfaces of airless bodies (e.g. the Moon, asteroids) in response to processes such as solar wind irradiation and micrometeorite bombardment. Over time, space weathering alters the surfaces of individual soil grains, producing thin (<200 nm) alteration rims, which can be comprised of amorphous material, vesicles, metallic iron nanoparticles, vapor deposits, and melt splashes. STEM, EELS, and EDS allow for sub-nanometer imaging and microanalysis of individual space weathered grains and can reveal important sample features typically inaccessible with bulk-level approaches. We are using these techniques to understand the individual and tandem influences of solar wind and micrometeorites, as well as the influence of mineralogy and exposure history, on the development of space weathering features. Additionally, we are characterizing solar wind-implanted volatiles (e.g. H, He) in lunar soils and determining how different curation conditions affect volatile retention. A better understanding of space weathering, including volatile production and cycling, is crucially important, not only for constraining the surface evolution of airless bodies, but for supporting future robotic and human exploration and in situ resource utilization.

Education:

B.S. Geology (2014) Eastern Michigan University

M.S. Geology (2016) Ball State University

- Thesis: “A TEM Investigation of the Phase Diversity of Nickel Phyllosilicates from New Caledonia”

Ph.D. Geology (2020) Miami University

- Dissertation: “Catalytic Properties of Novel Microporous Minerals”

Biography: My background is in terrestrial & extraterrestrial mineralogy, mineral alteration & surface reactions, and electron microscopy. I’m interested in using electron microscopy and microanalytical approaches to study planetary materials to better understand processes taking place across the Solar System and beyond.

Speaker 3: Dr Marina Potapova

Curator of Diatoms, The Academy of Natural Sciences

Associate Professor, Department of Biodiversity, Earth and Environmental Science, Drexel University

Talk Title: “Electron Microscopy in Diatom Research”

Abstract: Electron microscopy is an important tool for studying biological objects, including skeletons of microscopic organisms, such as diatoms. Diatoms are unicellular algae common and abundant in aquatic environment. They produce about 20% of all organic matter and oxygen on Earth, driving global biogeochemical cycles of carbon, silica and other elements. They are widely used as environmental indicators and biostratigraphic markers as their siliceous skeletons are well preserved in sediments of lakes and oceans. Diatom species identification is based on the morphological features of their skeletons, with electron microscopy essential for resolving their intricate structures The Academy of Natural Sciences of Drexel University houses the largest diatom collection in the Western Hemisphere, with samples from all over the World dating back to the days of the earliest diatom studies. Electron microscopy helps the Academy scientists to uncover the bewildering diversity of diatoms, discover new species and conduct cutting-edge research in paleolimnology and environmental assessment, including studies of aquatic pollution, climate change and sea-level rise

Biography: Dr. Potapova is an expert in the ecology and taxonomy of algae, especially diatoms, among the most important producers of organic matter and oxygen on Earth. She spent most of her career at the Academy of Natural Sciences (ANS), which became part of Drexel in 2012. She is a curator of the ANS Diatom Herbarium, the most extensive diatom collection in America.

Speaker 4: Dr. Kate Vanderburgh

Research Instrumentation Specialist, Materials Characterization Core, Drexel University

Title: Thermo Fisher Apreo 2S Lo Vac SEM: Highlights & Dynamic Capabilities

Abstract: The Drexel Materials Characterization Core (MCC) welcomed the addition of a new state-of-the-art scanning electron microscope (SEM) in July. The Apreo 2 S Lo Vac SEM is a high-resolution SEM optimized for *in situ* and *in operando* imaging and analysis. Capabilities include secondary electron imaging, backscattered electron imaging, integrated energy dispersive spectroscopy (EDS), electron backscattered diffraction (EBSD), inert gas transfer. In situ stages for mechanical testing include (tensile,

3 & 4 point bending), heating, cooling, cryo & electrochemical testing. This talk will highlight these dynamic imaging capabilities and demonstrate features for high-resolution imaging.

Biography: Dr. Kate Vanderburgh joined the MCC team in 2021 to manage the scanning electron microscopy and sample preparation tools. Kate received her Ph.D. in Materials Science from Vanderbilt University and joined Drexel following a post-doctoral research appointment at Lawrence Livermore National Laboratory. She has extensive experience in the synthesis and characterization of nanomaterials for battery applications.