IOWA STATE UNIVERSITY
Department of Mechanical Engineering

Molecular Engineering of Materials for Chemical Sensing and Microelectronics

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Abstract

Molecular engineering of new materials holds promise for improving human health, safety, efficiency, and quality of life. This presentation will describe strategies for molecular engineering of stimuli-responsive multifunctional materials. The first part of the presentation will describe several approaches for design, synthesis, and device integration of two-dimensional (2D) conductive metal-organic frameworks (MOFs) and covalent organic frameworks (COFs) to create devices with promising utility in chemical detection and capture. An emphasis will be placed on the fundamental understanding and molecular design of modular structure-property relationships within this class of 2D materials. The second part of this talk will introduce a novel approach to designing materials for temporary adhesion, which relies on the use of sublimable molecular solids, with promising utility in the fabrication of microelectronic devices.

Biography

Katherine was born and raised in Eastern Ukraine, and moved with her family to the state of Rhode Island during her freshman year in high school. She attended Boston College, where she developed a passion for Materials Chemistry, working in the laboratory of Lawrence T. Scott. She graduated with high honors in 2004, and later that year moved across the river to pursue graduate studies at Harvard University. In 2011, Katherine earned her Ph.D. in Chemistry from Harvard University under the guidance of George M. Whitesides. Her doctoral dissertation focused on the development and characterization of a simple and portable method that used magnetic levitation for density-based chemical analysis. She also contributed to several other research efforts in the areas of paper-based diagnostics and protein biophysics. Katherine then joined the laboratory of Timothy M. Swager at the Massachusetts Institute of Technology as an NIH postdoctoral fellow to pursue the development of portable electronic carbon-based chemical sensors for the detection of hazardous gases and vapors. At MIT, she developed a solvent-free approach, operationally analogous to drawing with pencil on paper, for the fabrication of sensitive and selective sensors from carbon nanomaterials. Katherine began her independent scientific career as an Assistant Professor in the Department of Chemistry at Dartmouth College in July 2015. Her research at Dartmouth focuses on the development of multifunctional materials using methods of bottom-up chemical synthesis and self-assembly for solving challenges in electroanalysis, microelectronics, and energy. She is a recipient of the Army Research Office Young Investigator Award (2017), Sloan Research Fellowship (2018), PMSE Young Investigator Award (2018), 3M Non-Tenured Faculty Award (2018-2019), and Cottrell Scholars Award (2019).

This seminar counts towards the ME 600 seminar requirement for Mechanical Engineering graduate students.

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