



SEMINARS IN CHEMICAL AND BIOMOLECULAR ENGINEERING



Friday, Feb. 15, 2019

10:00am - 11:00am

Boelter Hall 3400

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Postdoctoral Fellow

Materials Science and Engineering

SLAC National Accelerator Laboratory

"Synergizing High Capacitance with Fast Charging: Materials Design and Mechanisms"

As electronic technology advances, the need in safe and long-lasting energy storage devices that occupy minimum volume arises. Short charging times of several seconds to minutes, with energy densities comparable to those of batteries, can be achieved in pseudocapacitors. These are subclass of supercapacitors, where capacitance is mediated by fast redox reactions and can enable at least an order of magnitude more energy to be stored than in typical electrical double layer capacitors. Transition metal oxides (e.g. RuO₂, MnO₂) and conducting polymers (e.g. polyaniline) serve as typical examples. However, these materials are often high in cost and/or suffer from low cycling stability. As a result, the search for new pseudocapacitive materials constitutes an important direction today.

In my talk, I will discuss how the key performance metrics of pseudocapacitors – capacitance and charging rates – can be pushed to the limits in the materials that combine good electrical and ionic conductivities (ensuring fast charge transfer and hence charging rates) with high density of redox-active and ionically accessible sites (enabling high capacitance and charging rates). In particular, I will present the electrochemistry of new layered materials such as 2D transition metal carbides (MXenes) and hexaaminobenzene-based conductive MOFs for energy storage applications, with an emphasis on the mechanism of charge storage and factors affecting the electrochemical performance.

Dr. Lukatskaya is currently a postdoctoral fellow at SLAC National Accelerator Laboratory and Stanford University. She received her Ph.D. in December of 2015 from Drexel University in Materials Science and Engineering and B.Sc. in Materials Science, M.Sc. in Chemistry from Moscow State University, Russia. Her research focus is in areas of new materials and electrolyte development for electrochemical capacitors and batteries. She has published 34 papers in peer-reviewed journals and has received a number of international awards, including MRS Gold Graduate Student Award, American Ceramic Society Ceramographic Competition award.