ETH zürich

ICB seminar series 2020/21
chairman: Prof. Dr. Paolo Arosio

SYNERGIZING HIGH CAPACITANCE WITH FAST CHARGING: PSEUDO-CAPACITANCE IN 2D MATERIALS

Prof. Dr. Maria R. Lukatskaya
Department of the Mechanical and Process Engineering, ETH Zürich

Wednesday, 18/11/2020, 11.00 am
Zoom ID: tba

Abstract: 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 batteries, can be achieved in pseudocapacitors: a sub-class of supercapacitors, where capacitance is mediated by fast redox reactions and thus enables at least an order of magnitude more energy to be stored than in typical double layer capacitors. However, traditional pseudocapacitive materials are often high in cost and/or suffer from low cycling stability.
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 2D materials that combine good electrical and ionic conductivities (ensuring fast charge transfer and hence charging rates) with high density of redox-active sites. In particular, I will discuss the electrochemistry of 2D transition metal carbides (MXenes) and 2D conductive metal-organic frameworks, with an emphasis on the mechanism of charge storage and electrode design.

Bio: Dr. Maria Lukatskaya is a tenure track assistant professor of Electrochemical Energy Systems in Department of Mechanical and Process Engineering at ETH Zürich. Maria received her B.Sc./M.Sc. from Moscow State University, Russia and Ph.D. from Drexel University, USA followed by postdoctoral stay at Stanford University, USA and SLAC National Accelerator Laboratory, USA. Dr. Lukatskaya's group studies fundamental processes in solutions, materials and at the electrode-electrolyte interfaces and then applies this fundamental knowledge to the development of new battery materials, electrocatalysts and electrolytes that can deliver improved performance, cost, efficiency and safety. Dr. Lukatskaya received a number of international awards, including Energy and Environmental Science Lectureship Award, Argonne National Laboratory Director Fellowship, MRS Gold Graduate Student Award, The George Hill, Jr. Endowed Fellowship Fund.