DREXEL UNIVERSITY
Materials Science and Engineering
College of Engineering

Department of Materials Science and Engineering,

Candidacy Exam

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2D Materials as Electrodes for Zinc-ion and Zinc-metal Energy Storage Systems

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Abstract

The demand for electrochemical energy storage is rapidly growing as energy distribution undergoes electrification, and society adopts an internet of things in our daily lives. The need for low-cost grid storage, flexible and wearable electronics, and high safety applications has led researchers to look beyond lithium-based energy storage. Zinc-based energy storage systems are of interest due to the low cost and abundance of zinc, its high safety and stability in water, and its use of environmentally friendly electrolytes. Zinc metal batteries are already well established in the primary battery industry but have not had the same success in secondary batteries due to rechargeability issues at the anode (dendrite/dead zinc formation) and cathode dissolution/degradation. Two-dimensional (2D) materials present themselves as potential electrode materials for zinc-metal and zinc-ion energy storage systems. Their sheet-like structure allows for fast surface interactions to be coupled with inter-gallery diffusion, leading to improved ion transport kinetics. In this seminar, I will be presenting on the current efforts made to study different 2D materials as electrodes for zinc ion and zinc metal energy storage systems. These materials include 2D transition metal oxides/carbides/dichalcogenides, organic frameworks, and graphene derivatives.