

MIT Chemical Engineering Department

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Materials Design and Electrochemical Methods for Water-Energy Nexus: From Water Purification to Resource Mining



Chong Liu

Dept of Materials Science & Engineering
Stanford University

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4:15pm, refreshments at

4:00pm

66-110

Abstract:

Water, resource, and energy are the foundation for the sustainable future. Applications in water-energy nexus require the control of phenomena that span enormous length scales. Materials design with precise atomic compositions and tailored microstructures as well as kinetics manipulation are the keys to achieve high performance. In this talk, I will first introduce the alternating current electrochemical method for resource mining from water. This method combined with surface functionalized electrodes can extract targeted resource species with extremely high capacity and selectivity. This method is successfully demonstrated for uranium extraction from seawater and heavy metals recovery from wastewater. It opens an eco-friendly route of mining from earth water system with minimal impact on the environment. Moreover, freshwater security is another focus of sustainability that is of paramount importance to public health, especially for developing areas with limited energy supply and insufficient infrastructures. By synthesizing nanomaterials with optimized physical properties and morphologies, we achieved rapid and efficient bacteria and viruses inactivation through photocatalysis and also enabled a new method based on electroporation.