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Low Temperature Carbon/Nitrogen Plasma Engineered High-performance Electrode Materials for Energy Storage and Conversion

Wednesday, 20 September 2023 14:30 (30 minutes)

The focus of this presentation will be on fabrication of cost-, time- and energy-efficient 3-D nanostructured electrode materials for high-performance energy storage (Li/Na ion batteries) and energy conversion (half/full cell) devices using low-temperature carbon/nitrogen plasmas. For energy storage devices, the electrode materials, particularly the anode materials, significantly influence the performance and efficiency of energy storage batterie as the anode is responsible for storing and releasing ions (e.g., lithium or sodium) during charge and discharge cycles. Similarly, for applications in electrochemical energy conversion processes such as hydrogen and oxygen evolution reactions, the research on electrode materials drives advancements in catalyst activity, electrochemical efficiency, stability and durability, cost and abundance, scalability, and integration. The exploitation of new materials and modification of existing materials at the atomic level are two prime strategies to increase the performance of these devices. Innovative and environmentally friendly synthesis and processing technologies, other than wet chemistry approaches, for development of new materials with desired structural, morphological, physical and chemical properties are actively being explored to achieve improved performance of energy materials. Low-temperature non-thermal carbon/nitrogen-plasma-based synthesis and processing strategies have been actively explored by us to demonstrate that it indeed serves as a promising tool for the preparation of advanced porous 3-D nanoassemblies that provide electrode materials with excellent capacity, capacity retention, cycling, charge transport, low overpotential, and high-stability. In this proposed talk I will provide the overview of the work done on using low temperature carbon/nitrogen plasma in RF-PECVD system to process, dope and synthesize energy storage and conversion materials with significantly improved electrochemical performances.

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