

Role of supercritical fluids in synthesizing high-performance cathodes and anodes for lithium- and sodium-ion batteries

Jaehoon Kim

School of Chemical Engineering, School of Mechanical Engineering, SKKU Advanced Institute of Nano Technology (SAINT), Sungkyunkwan University, 2066, Seobu-Ro, Jangan-Gu, Suwon, Gyeong Gi-Do, 440-746, Republic of Korea

Supercritical fluids can offer environmentally benign, highly effective, facile synthetic conditions for developing new green processes for producing various types of energy materials and for developing energy conversion processes, owing to their unique physical properties (low viscosity, fast diffusion, zero surface tension), tunable physical and chemical properties, and unique reactivity. These factors make supercritical fluids highly promising media for overcoming the barriers associated with traditional techniques, including the generation of toxic reaction waste, difficulty in producing nanostructured electrode materials with a high energy and power density, and transport limitations, and catalyst deactivation in energy conversion process. In this talk, the unique role of supercritical fluids in synthesizing high-performance cathode and anode materials for lithium- and sodium-ion batteries will be discussed. In particular, synthesis of nanostructured LiFePO_4 and $\text{Li}_4\text{Ti}_5\text{O}_{12}$ in supercritical water and supercritical alcohols will be discussed. Ultrathin and uniform carbon coating on the surface of nanostructured active materials in liquid carbon dioxide will be discussed. In addition, one-pot synthesis of metal oxide-graphene composites in supercritical alcohols will be covered. Lastly, alkali-ion storage mechanism in hard carbon, adsorption followed by intercalation, will be discussed.