Crystal Water for Advanced Sodium and Magnesium Rechargeable Batteries

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Although Li-ion batteries have been successful in various applications, their shortcomings with regard to high cost and global maldistribution of raw materials, as well as safety concerns have stimulated alternative rechargeable batteries based on other carrier ions represented by sodium and magnesium ions, targeting grid-scale energy storage systems (ESSs). However, many electrode materials in these emerging systems often suffer from sluggish kinetics due to the larger size or bivalency of carrier ions, limiting electrochemical performance particular in specific capacity and operation voltage. In this talk, I will introduce a new approach of engaging crystal water in layered cathode materials. The crystal water improves the performance of the given materials substantially by shielding electrostatic interactions or maintaining the crystal frameworks over repeated cycles. Detailed effects of crystal water will also be described [1,2], along with promising potentials towards aqueous operations. Electron microscopy characterization for in-depth understanding of these materials will also be introduced [3].

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