Solvent-Dictated Sodium Sulfur Redox Reactions:
Investigation of Carbonate and Ether Electrolytes

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Sulfur-based cathode chemistries are essential for the development of high energy density alkali-ion batteries. Here, we elucidate the redox kinetics of sulfur confined on carbon nanotubes, comparing its performance in ether- and carbonate-based electrolytes at room-temperature. The solvent is found to play a key role for the electrochemical reactivity of the sulfur cathode in Na–S batteries. Ether-based electrolytes contribute to a more complete reduction of sulfur and enable a higher electrochemical reversibility. On the other hand, an irreversible solution-phase reaction is observed in carbonate solvents. This study clearly reveals the solvent-dependent Na–S reaction pathways in room-temperature Na–S batteries, and provides an insight into realizing their high energy potential via electrolyte formulation design.

Keywords: sodium-sulfur; redox kinetics; carbonate; ether; electrolyte

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