



Showcasing research from Professor Sunghwan Lee's Laboratory of Thin Film Materials and Devices, School of Engineering Technology, Purdue University, West Lafayette, IN, USA.

Fast-charging sodium metal anodes: challenges, degradation mechanisms, and interphase engineering strategies

As renewable energy integration increases, efficient grid-scale storage becomes essential, motivating fast-charging sodium metal batteries for stationary applications. High-rate operation triggers degradation distinct from conventional cycling, including accelerated SEI rupture/reformation, diffusion-limited Na⁺ depletion, dendritic growth, and void-driven dead sodium accumulation. This review analyzes these rate-specific failure modes and establishes design principles for artificial SEIs, emphasizing ultrathin, robust layers that homogenize ion flux. By surveying recent inorganic, organic, and hybrid interphases, the work outlines pathways toward safe, durable sodium metal anodes for large-scale deployment.

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See Sunghwan Lee *et al.*, *RSC Appl. Interfaces*, 2026, **3**, 214.