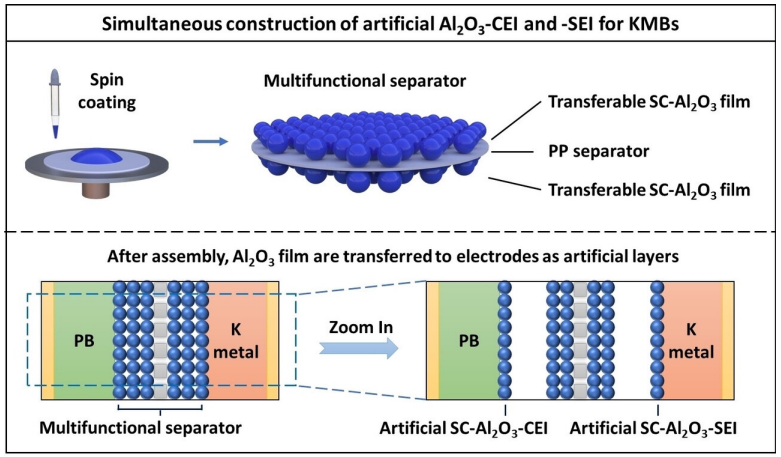
Artificial and Stabilized Interfaces in Potassium Metal Batteries

Scientific Achievement

The creation of an artificial SEI/CEI using a spin coating of alumina (Al_2O_3) nanopowder, substantially enhancing the electrochemical kinetics of potassium metal batteries (KMBs).



A thin film (10 µm) of alumina (Al_2O_3) nanopowder is spin-coated on both sides of commercial polypropene separators, then transferred onto both anode and cathode surfaces during cell assembly.This creates both artificial solid-electrolyte interphase (SEI) and cathode electrolyte interface (CEI) that enhance electrochemical kinetics of potassium metal batteries (KMBs).

Significance and Impact

Demonstrated state-of-the-art electrochemical properties and general approach for stabilizing electrochemical interphases in K metal batteries.

Research Details

- Al_2O_3 is stabilizes sodium metal batteries but is difficult to coat onto low melting-point K anodes.
- We address this challenge by room-temperature spin coating 10 µm films of Al_2O_3 nanopowder onto both sides of a commercial polypropylene separator.
- Spin-coated Al_2O_3 prevents dendrite filament growth (half-cells) and cycling-induced cracking (full-cells).

Liu, P.; Hao, H.; Singla, A.; Vishnugopi, B. S.; Watt, J.; Mukherjee, P. P.; Mitlin, D., *Alumina - Stabilized SEI and CEI in Potassium Metal Batteries*. Angewandte Chemie, International Edition. 2024, e202402214.

This work was performed, in part, at the Center for Integrated Nanotechnologies.