UNIVERSITY OF ALBERTA
TECHNOLOGY TRANSFER SERVICES

A Cellulose Encapsulated Composite Electrolyte Membrane for All Solid-Sodium Batteries

ID# 2025-023

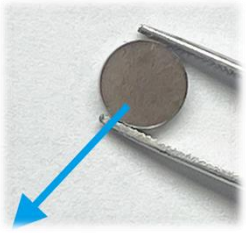
HIGHLIGHTS

- Ion conductivity comparable to commercial liquid electrolytes.
- Scalable water-mediated thin membrane fabrication.
- Significantly improved ionic conductivity, moisture resistivity, and electrochemical stability.

OPPORTUNITY

Sulfide- and halide-based ceramic ionic conductors offer ionic conductivity similar to that of liquid electrolytes, making them suitable candidates for high-energy and high-power-density all-solid-state batteries. However, their inherent brittleness makes it challenging to fabricate thin membranes for practical batteries.

The Sang research laboratory at the University of Alberta have developed a cellulose-encapsulated sodium thioantimonate (NSS) composite electrolyte for high-energy-density solid-state sodium batteries. They created a thin (sub-hundred micrometers) yet robust electrolyte membrane using a cost-effective water-assisted solution process. This ultra-thin sodium carboxymethyl cellulose (CMC) encapsulation slightly reduces Na+ mobility but increases Na+ conductance due to the reduced thickness. The CMC coating also acts as a barrier, protecting NSS from metallic Na electrodes, moisture, and extremely negative potentials. During electrochemical tests over 250 cycles, the CMC coating remains stable with minor structural changes.



NSS-CMC

NSS-CMC thickness measurement

COMPETITIVE ADVANTAGE

- Improved moisture resistivity and electrochemical stability, leading to better cycling performance.
- Offers 5-fold increase in Na+ conductance due to reduced electrolyte thickness.
- The thin (~100 micrometer) NSS−CMC composite electrolyte pellets are more flexible and ductile compared to ceramic NSS pellets that are 10% thicker.

STATUS

- Patent pending.

INVENTORS

- Dr. Lingzi Sang

MORE INFORMATION

Joanna Preston
Director
Technology Transfer Services, University of Alberta
780.265.1075
jpreston@ualberta.ca