

**Materials Day**  
**Abstract Guide**  
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**Atomic layer deposition of interfacial coatings for all-solid-state lithium metal batteries**

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The all-solid-state lithium metal battery offers high energy density double that of current Li-ion batteries. However, the electrochemical stability remains a challenge, with many Li-S cells showing poor cycling stability. Of particular importance is the interface of Li metal and solid electrolyte: inevitable electrochemical reactions result in a solid-electrolyte interface (SEI) which is known to be critical to cycling stability and formation of Li metal dendrites. Therefore, efforts have turned towards the design of a protective interlayer – a sort of artificial SEI – inserted between the Li metal anode and solid electrolyte during assembly, which prevents Li dendrites and prevents unwanted side reactions with solid electrolyte.

This work proposes an interlayer of porous carbon black which has been coated with ZnO using atomic layer deposition (ALD), mediating Li deposition to prevent dendrites and providing a stable buffer layer at this critical interface. The ALD process is developed and characterized, showing homogenous and conformal coverage of the carbon, and the effect of deposition thickness on interlayer effectiveness is examined. The ZnO-coated carbon layer enables stable Li plating and stripping for over 500 hours of cycling at a Coulombic efficiency of 99% in a half-cell configuration. A full-cell using a sulfide solid electrolyte and an advanced sulfur cathode with high specific capacity (>1200 mAh/g) can potentially demonstrate an all-solid-state lithium-metal battery with high energy density and long cycle lifetime.