

# ARG SEMINAR

## Tailored Dual-layer SEI Interface for Dendrite-Free and Stable Anode-Free Battery

### DATE/TIME

May 8th, 2026

13 : 00~14:00

### VENUE

**AICS 411**

Shinshu University

Nagano (Engineering) Campus, E2 Bldg.

### SPEAKER

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# Tailored Dual-layer SEI Interface for Dendrite-Free and Stable Anode-Free Battery

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Anode-free lithium metal batteries have emerged as a promising candidate to address the growing demand for high-performance energy storage technologies, as a result of their high energy density. Nevertheless, their practical use is substantially limited by two fundamental challenges. The initial concern is the localized lithium-ion deposition, which is a result of the current collector's non-uniform current distribution and inherent surface irregularity. This condition induces dendritic growth and accelerates electrolyte degradation as a result of the high reactivity of newly deposited lithium, which results in irregular lithium plating. The intrinsic instability of conventional liquid electrolytes at low voltages is the second challenge. In anode-free configurations, the voltage must approach 0 V versus Li/Li<sup>+</sup>, a range where no common liquid electrolyte can maintain electrochemical stability. Ultimately, this leads to premature battery failure as a result of capacity decline and dry-out, as well as continuous electrolyte decomposition and progressive electrolyte depletion. In response to these critical issues, this study introduces a novel dual-function artificial solid electrolyte interphase (SEI) layer that is intended to enhance the operational life and stability of anode-free batteries. The initial functional layer exhibits a high dielectric property, which facilitates a more consistent lithium plating process [1]. This structure effectively supports extended cycling stability and mitigates dendrite formation. Metal-organic frameworks (MOFs) are incorporated into the second functional layer, which functions as a selective ionic filter. This filter facilitates the transport of lithium ions, while simultaneously suppressing solvent decomposition and reducing electrolyte consumption. The combination of these two layers results in a robust artificial SEI that substantially enhances performance. Full cells exhibit stable cycling for over 400 cycles at 0.5 mAh/cm<sup>2</sup> and 1 mA/cm<sup>2</sup>. This dual-layer approach presents a promising approach to the development of anode-free lithium metal batteries that are both safer and more durable, thereby facilitating the transition to next-generation energy storage technologies.

## References

1. Tamwattana, O.; Park, H.; Kim, J.; Hwang, I.; Yoon, G.; Hwang, T.-H.; Kang, Y.-S.; Park, J.; Meethong, N.; Kang, K. , ACS energy lett., 6(12), 4416 (2021)