

Revealing the Synergistic Effect of LiF and Li₃N in Solid Electrolyte Interphase for Stable Lithium Metal batteries via In-Situ Electrochemical Atomic Force Microscope

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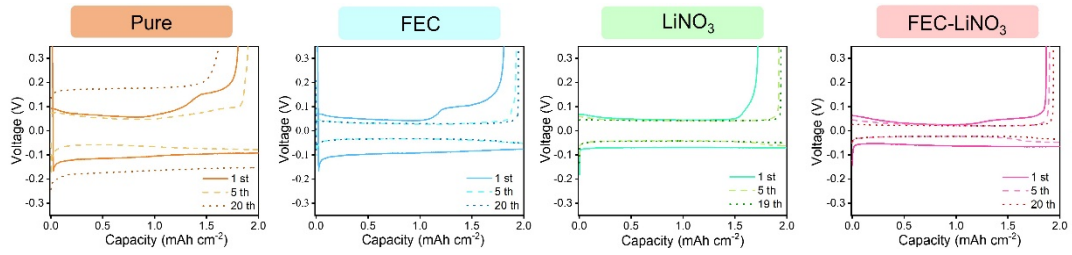


Figure S1. Voltage capacity profiles of different cycles for plating capacities of 2.0 mAh cm^{-2} in different electrolytes.

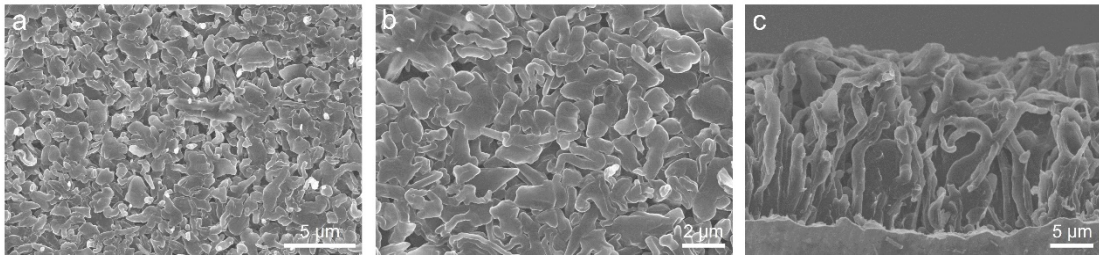


Figure S2. Top view (a-b) and cross view (b) SEM images of Li metal deposited at 1.0 mA cm^{-2} for 2 h (2.0 mAh cm^{-2}) after plating in pure electrolyte.

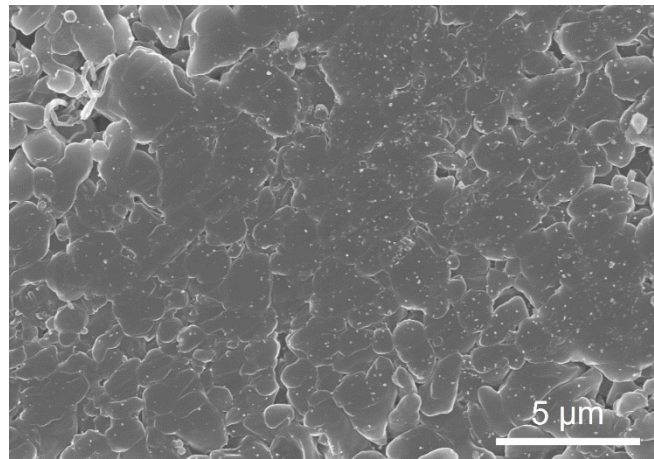


Figure S3. SEM images of Li metal deposited at 1.0 mA cm^{-2} for 2 h (2.0 mAh cm^{-2}) after plating in FEC electrolyte with low magnifications.

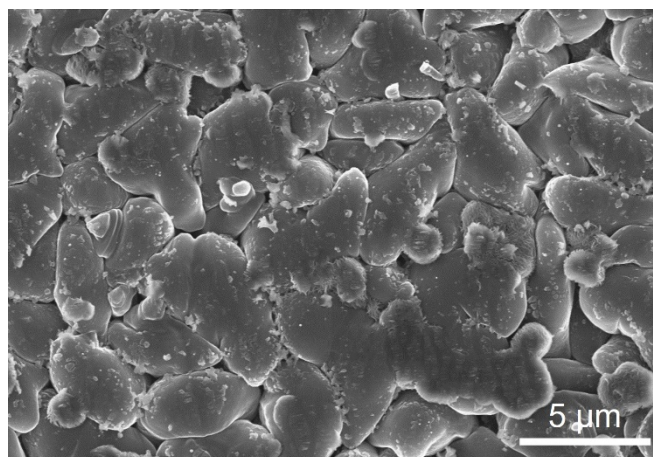


Figure S4. SEM images of Li metal deposited at 1.0 mA cm^{-2} for 2 h (2.0 mAh cm^{-2}) after plating in LiNO_3 electrolyte with low magnifications.

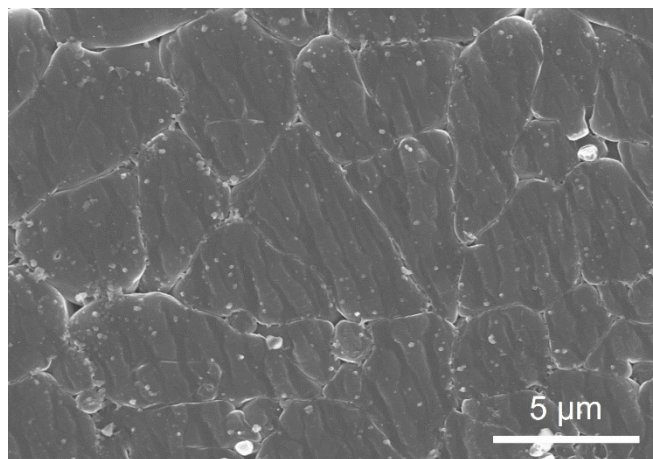


Figure S5. SEM images of Li metal deposited at 1.0 mA cm^{-2} for 2 h (2.0 mAh cm^{-2}) after plating in FEC-LiNO_3 electrolyte with low magnifications.

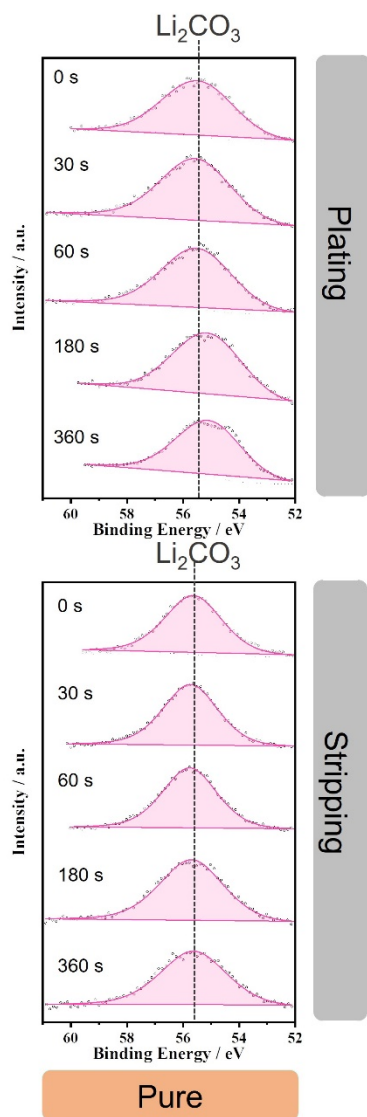


Figure S6. XPS Li 1s depth profiles of the SEIs after Li plating and stripping process in pure electrolyte.

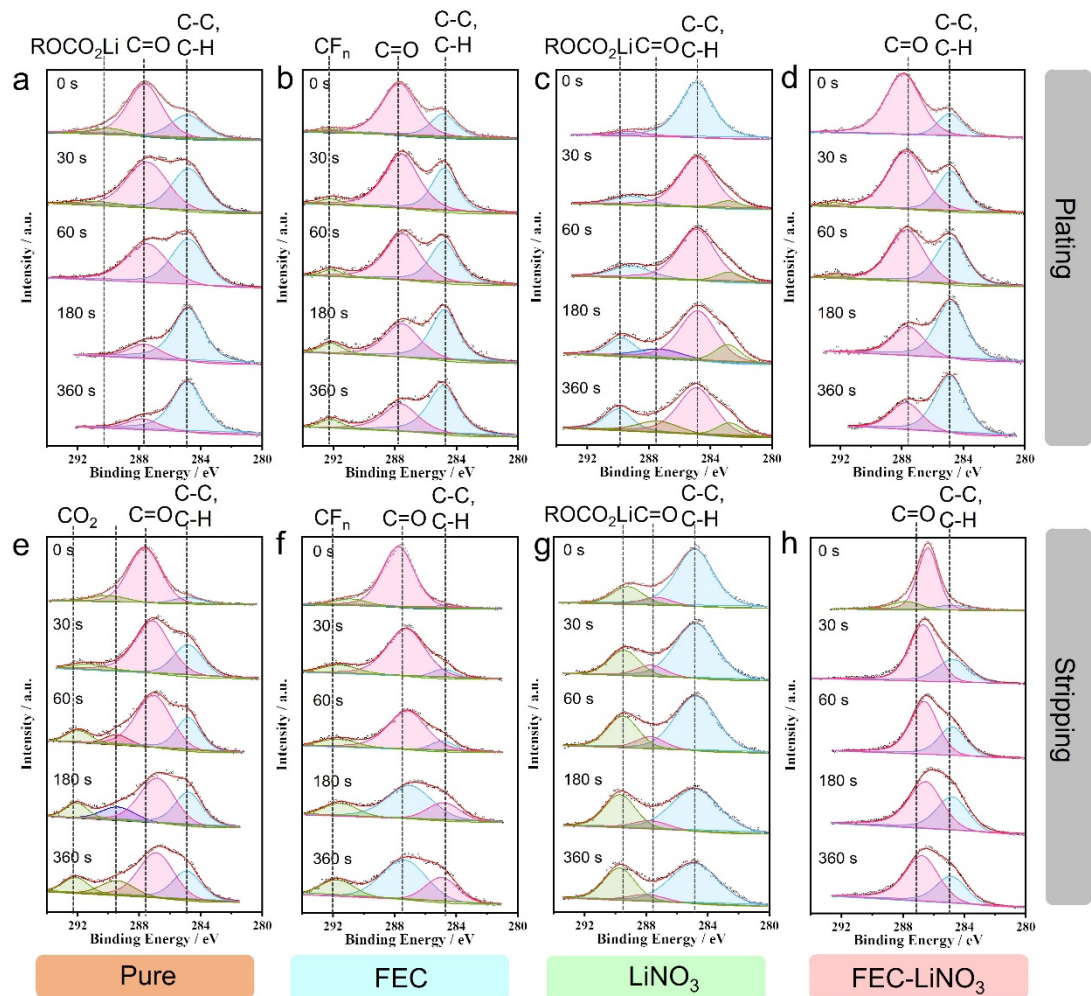


Figure S7. XPS C 1s depth profiles of the SEIs after Li plating and stripping process in pure electrolyte (a, e), FEC electrolyte (b, f), LiNO₃ electrolyte (c, g) and FEC-LiNO₃ electrolyte (d, h) with different depth of SEIs due to Ar⁺ sputtering (0s, 30s, 60s, 180s and 360s).

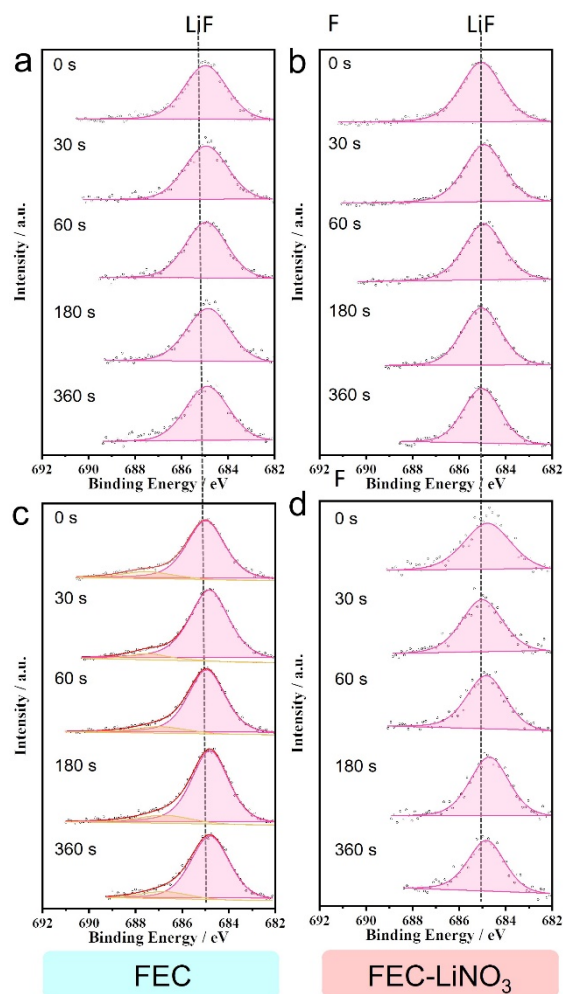


Figure S8. XPS F 1s depth profiles of the SEIs after Li plating and stripping process in FEC electrolyte (a, c) and FEC-LiNO₃ electrolyte (b, d) with different depth of SEIs due to Ar⁺ sputtering (0s, 30s, 60s, 180s and 360s).

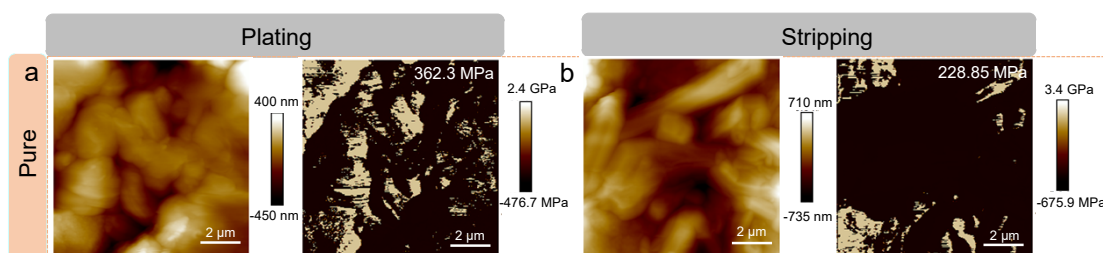


Figure S9. AFM and modulus images of SEI on Li metal after plating at 1.0 mA cm⁻² for 2 h (2.0 mAh cm⁻²) and stripping to 1V in pure electrolyte.

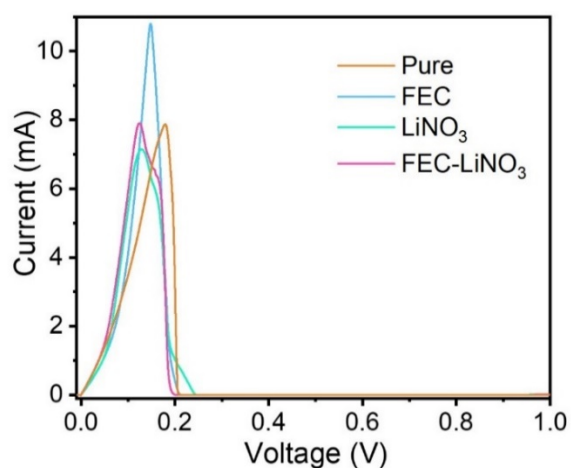


Figure S10. The LSV curve between 0-1.0 V at a scan rate of 0.1 mVs^{-1} .

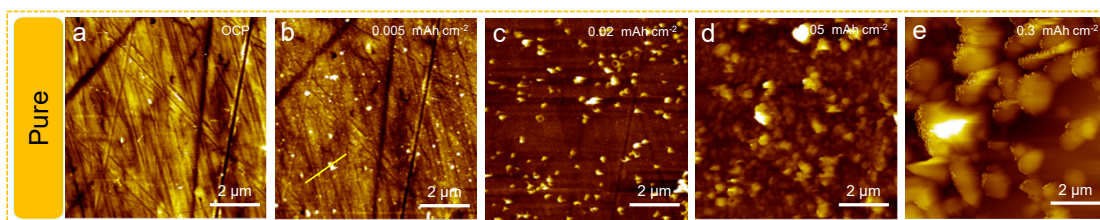


Figure S11. In situ AFM images of Li metal nucleation and growth. Morphology of the Cu foil during galvanostatic discharge at 1.0 mA cm^{-2} for 18 s ($0.005 \text{ mAh cm}^{-2}$), 72 s (0.02 mAh cm^{-2}), 180 s (0.05 mAh cm^{-2}) and 1080 s (0.3 mAh cm^{-2}) in pure LiBOB-based electrolyte without any LiNO_3 or FEC additives.

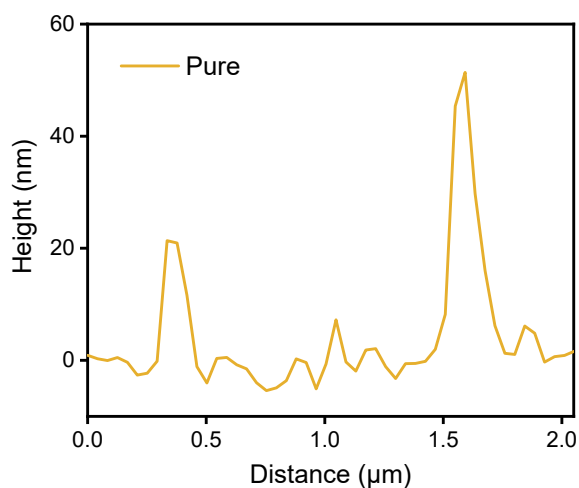


Figure S12. The corresponding height curves in corresponding to the marked regions in Figure S11b in pure LiBOB-based electrolyte without any LiNO_3 or FEC additives.