Supporting Information

Unraveling the mechanism of methyl acetate additive for reinforcing solid electrolyte interface on graphite anodes

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Solvent	Melting Point (℃)	Boiling Point (℃)	Viscosity (cP)	Dielectric Constant (ε)
Ethylene Carbonate	36.4	248	19.7	89.8 (40℃)
Dimethyl Carbonate	0.5	90.5	0.585	3.09 (25℃)
Diethyl Carbonate	-43	127	0.748	2.82 (25℃)
Methyl Acetate	-98	57	0.40	6.68 (25℃)

Table S1 Physical properties of ethylene carbonate, dimethyl carbonate, diethyl carbonate methyl acetate.

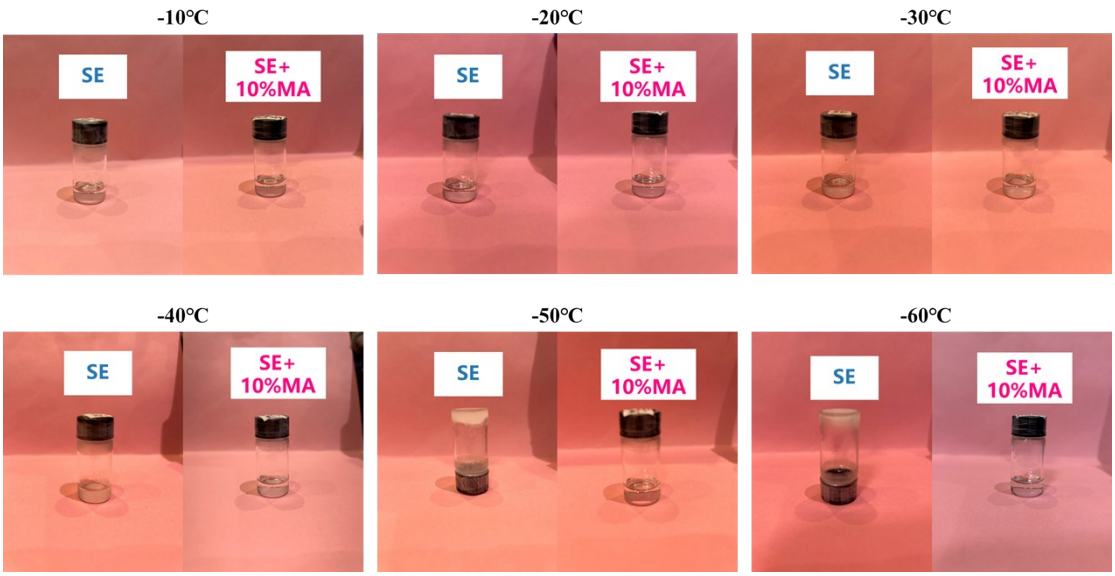

Figure S1 The state pictures of the electrolyte SE and SE+10%MA at the temperature from -10 ℃ to -60 ℃. Both electrolytes remain liquid at -40 ℃. SE electrolyte solidifies at -50 ℃, but SE +10%MA remain liquid at -60 ℃.

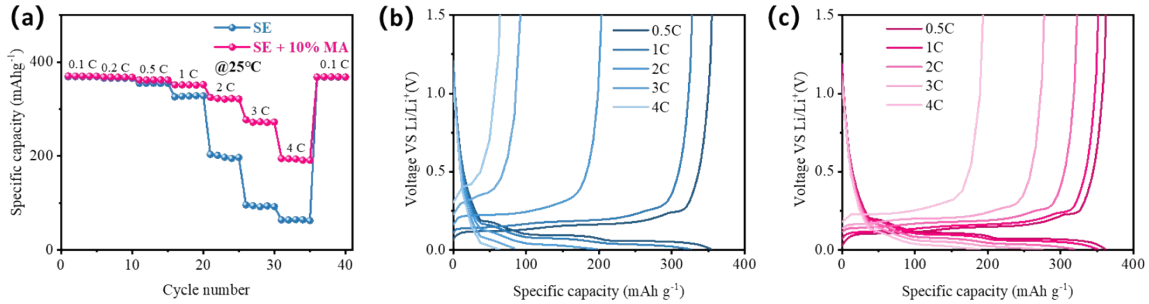

Figure S2 (a) The rate performance of Li||Gr cells from 0.1C to 4C (1C=372 mAh g^{-1}). The voltage evolution profiles of Li||Gr half cells at different rate in the electrolyte (b) SE and (c) SE + 10%MA.

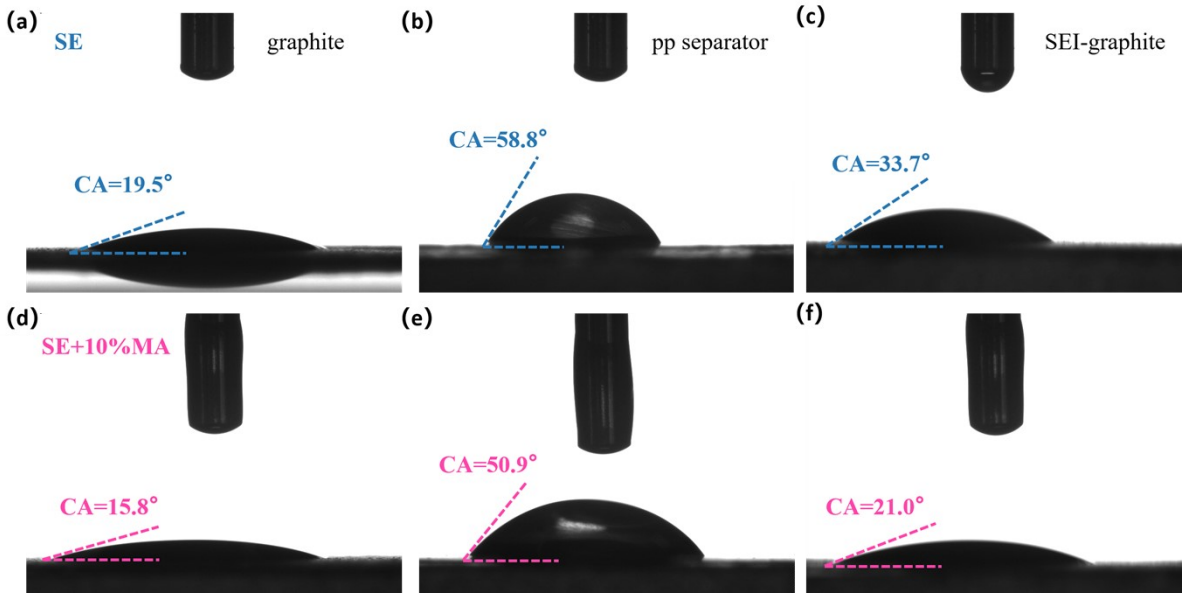

Figure S3 Photographs of contact angle (CA) test of SE electrolyte for the (a) pristine graphite electrode (b) pp separator and (c) RT-activation SEI-graphite. SE+10%MA electrolyte for the (d) pristine graphite electrode (e) pp separator and (f) RT-activation SEI-graphite.

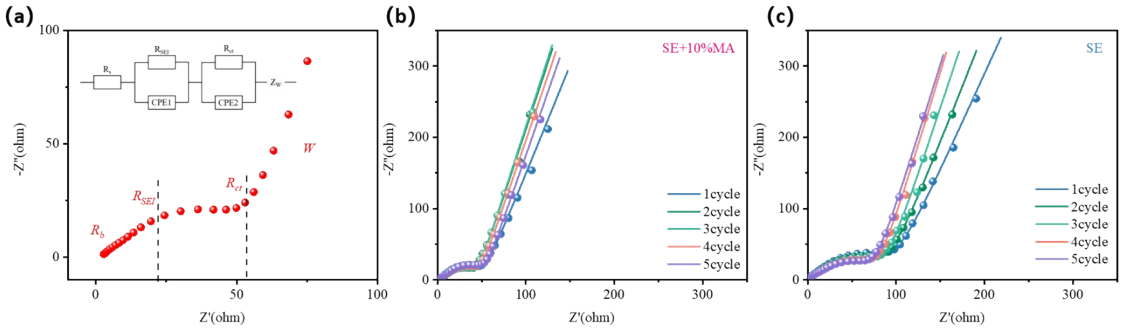

Figure S4 (a) Equivalent circuit for the simulation of EIS results. EIS test results and fitted lines of graphite anodes in (b) SE and (b) SE+10%MA.

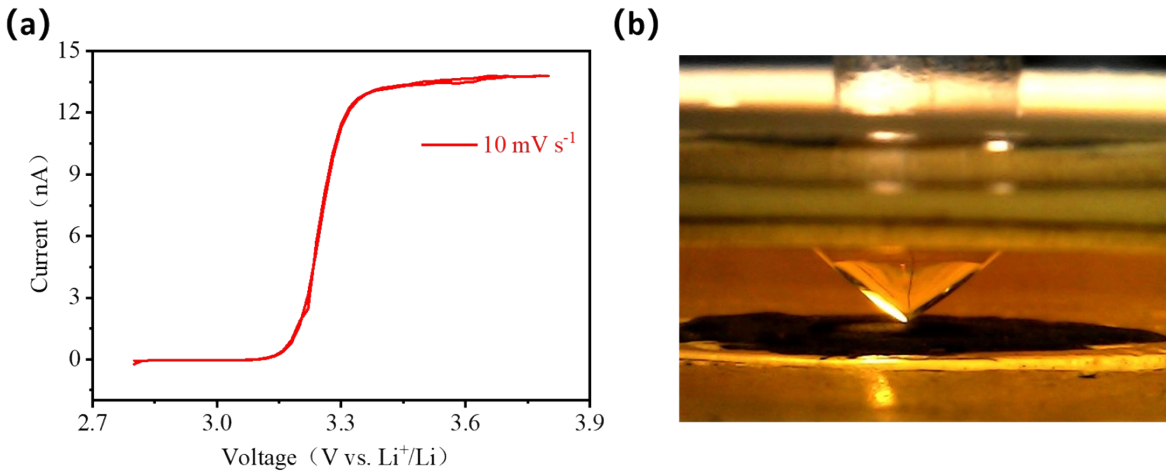

Figure S5 (a) Cyclic voltammetry of the microprobe cycled between 2.8 V and 3.8 V vs. Li^+ /Li at a scan rate of 10 mV s^{-1} in SE containing 10 mM Fc. (b) Photography of the microprobe above the graphite electrode observed from the optical microscope.

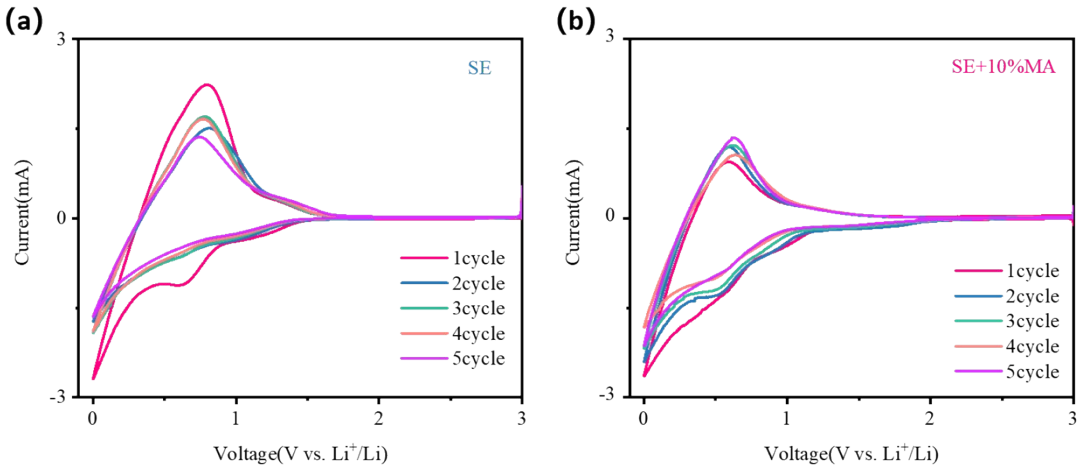

Figure S6 CV curves of graphite electrodes in the potential window of 3.0-0.001 V vs Li^+ /Li at a scan rate of 1 mV s^{-1} in the electrolyte (a) SE and (b) SE+10%MA.

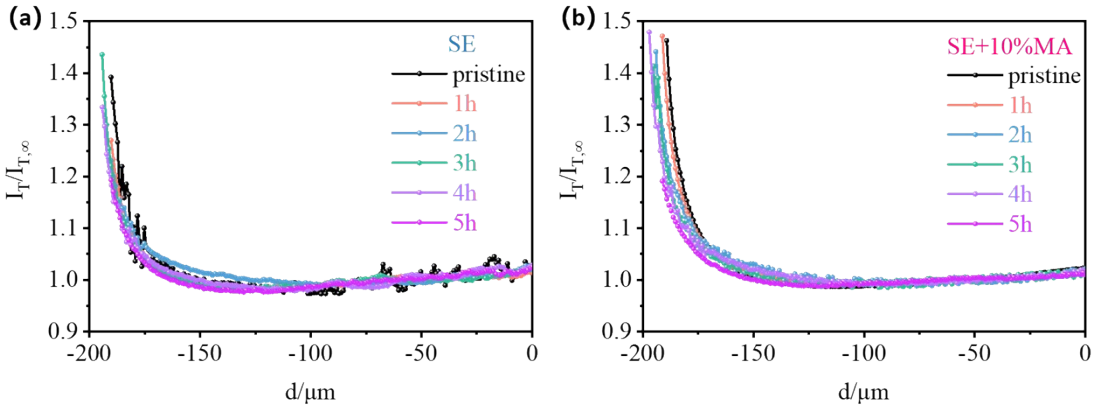

Figure S7 Approach curves with a bias of 3.5 V on the microprobe toward graphite electrodes during the immersion for 5 hours in the electrolyte (a) SE and (b) SE+10%MA.

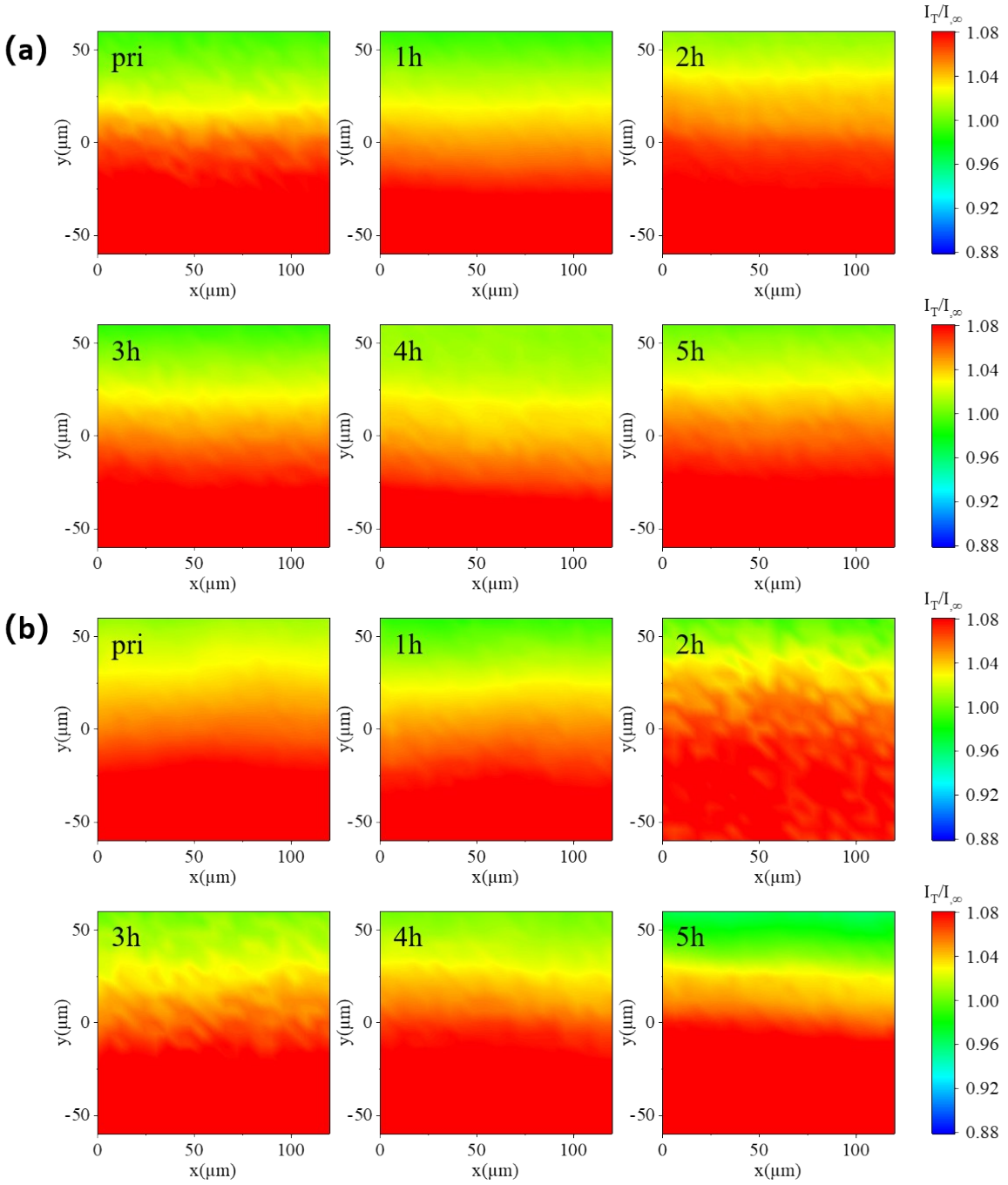

Figure S8 Area scan with a bias of 3.5 V on the microprobe toward the graphite electrode during the immersion for 5 h in the electrolyte (a) SE and (b) SE+10%MA.

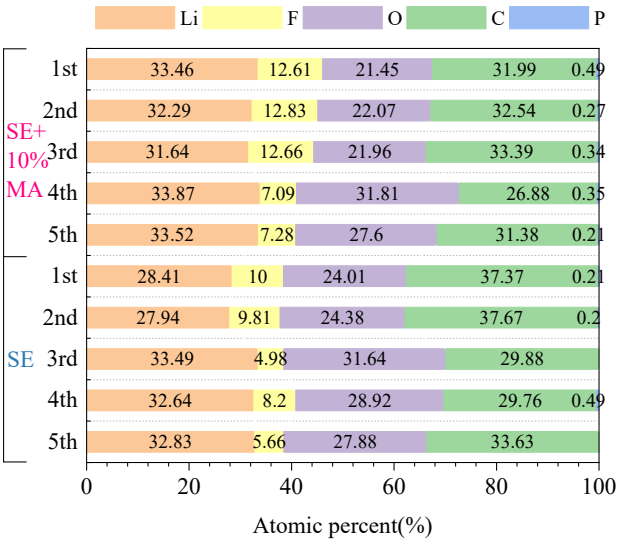

Figure S9 XPS analysis of atomic concentration at different depth in electrolyte SE and SE +10%MA.

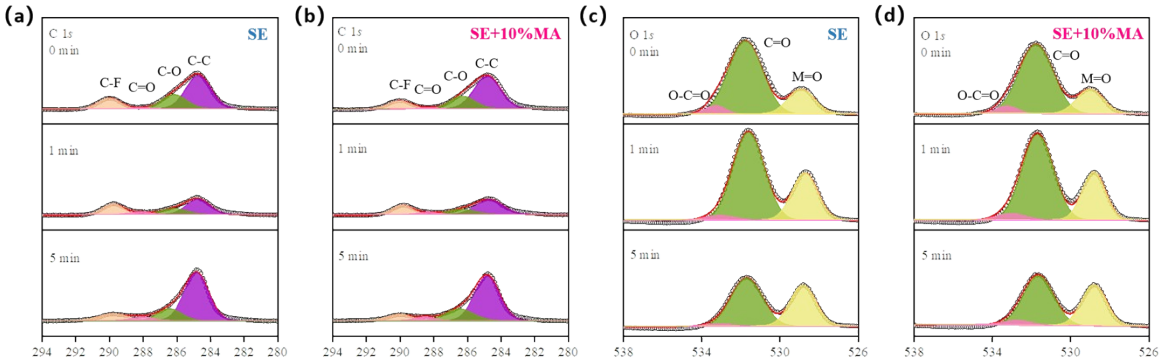

Figure S10 C 1s XPS spectra of the SEI on graphite electrodes at different depths in (a) SE and (b) SE+10%MA. And the O 1s spectra (c) SE and (d) SE+10%MA.

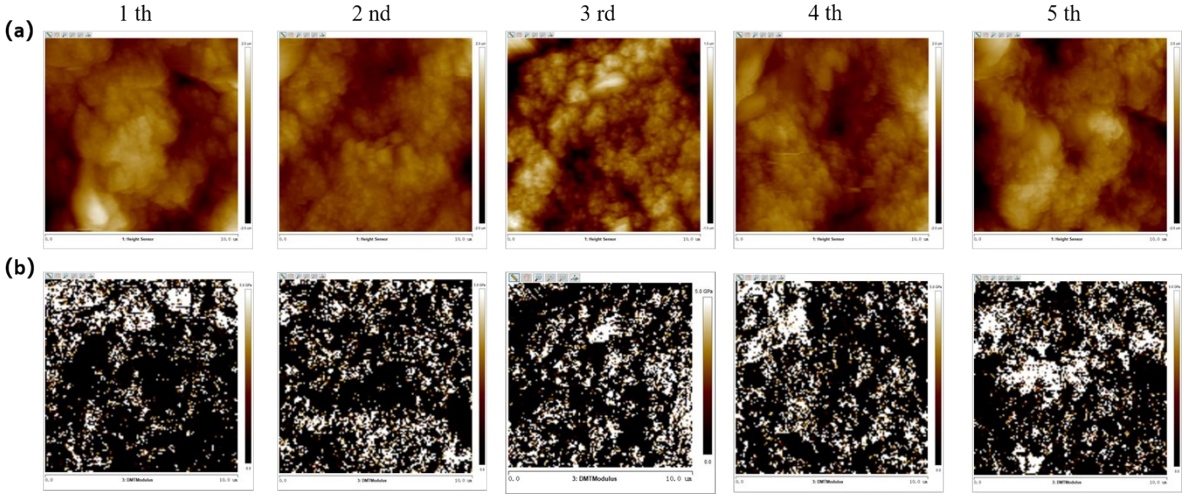

Figure S11 AFM monitoring of the evolution on the surface of graphite anode after 1-5 cycles in SE +10%MA. (a) Morphology of the graphite electrode after 1-5 cycles. (b) The modulus mapping images.

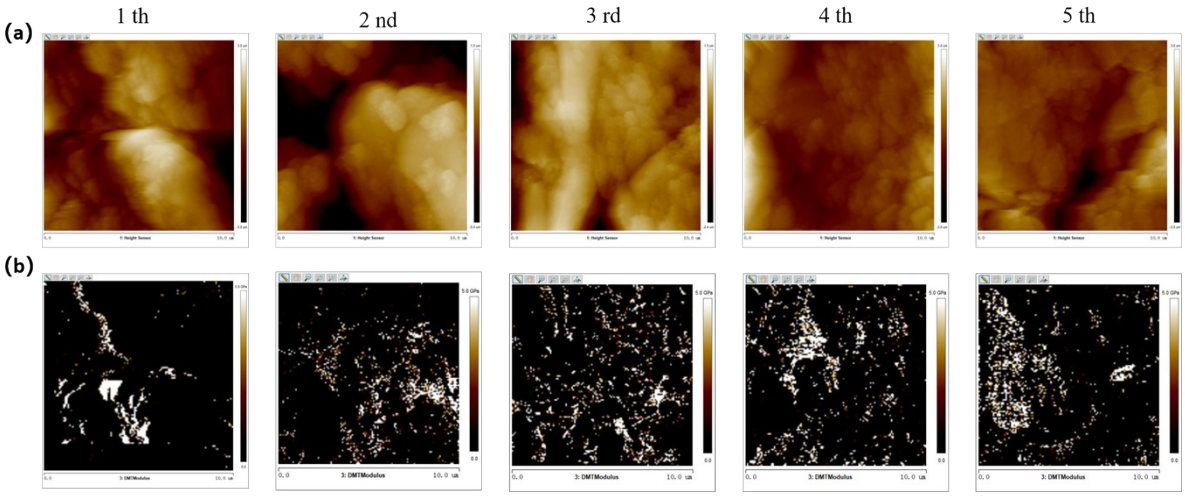

Figure S12 AFM monitoring of the evolution on the surface of graphite anode after 1-5 cycles in SE. (a) Morphology of the graphite electrode after 1-5 cycles. (b) The modulus mapping images.