Supporting Information

$AlCl_3$-Graphite Intercalation Compounds as Negative Electrode Materials in Lithium-ion Capacitors

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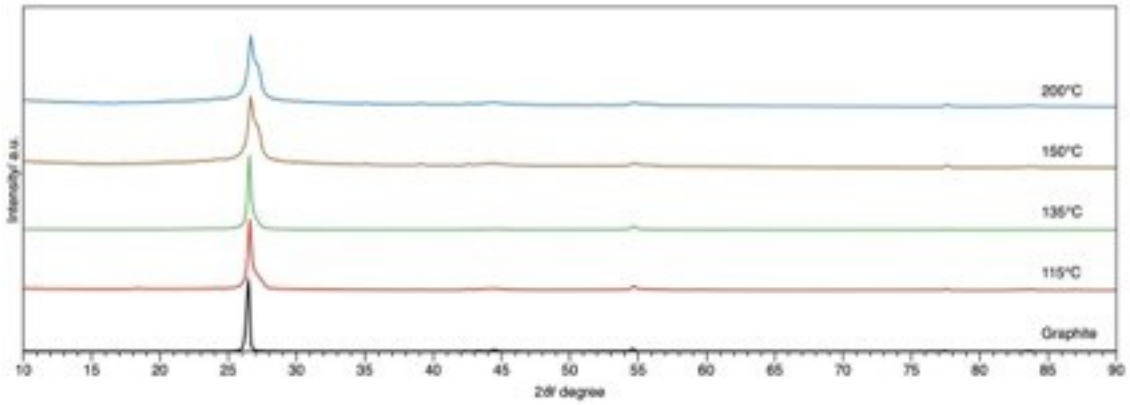

Figure S1. XRD patterns in a wide range of $AlCl_3$-GICs synthesized at different temperatures and labeled according to the heating temperature (115, 135, 150, 200).

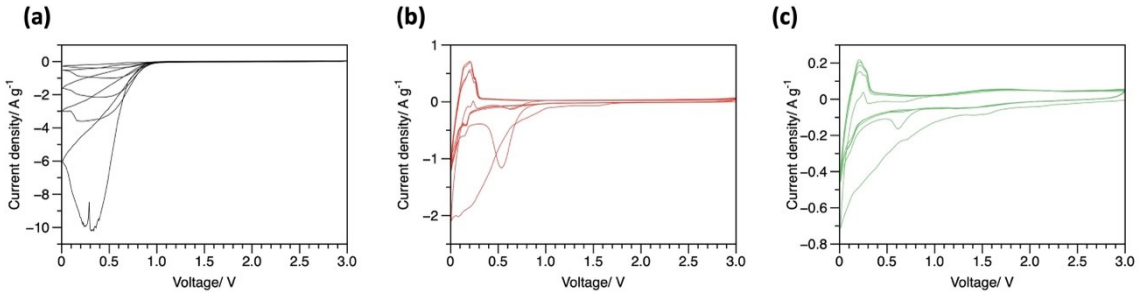

Figure S2. Cyclic voltammograms of (a) graphite, (b) and (c) $AlCl_3$-GIC (115 and 200) measured using 2032-type coin cells with 1 M $LiPF_6$ in PC as the electrolyte and Li metal foil as the counter electrode. CV was obtained in a voltage range of 0.01-3.0 V with a scan rate of 0.2 mV s^{-1}.

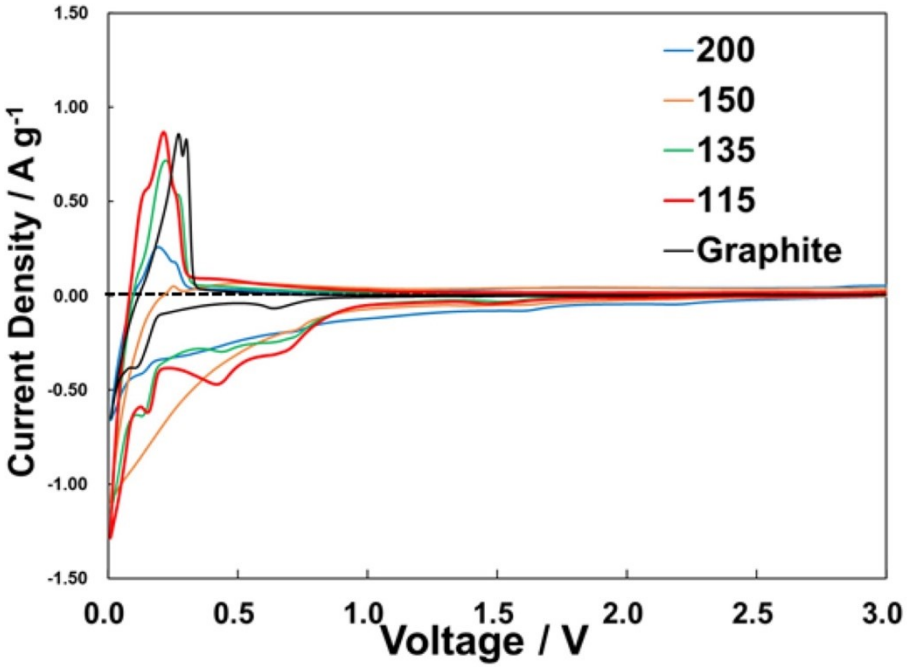

Figure S3. Cyclic voltammogram at an initial cycle of graphite and $AlCl_3$-GICs (115, 135, 150, and 200). CV was obtained in a voltage range of 0.01-3.0 V with a scan rate of 0.2 mV s^{-1}.

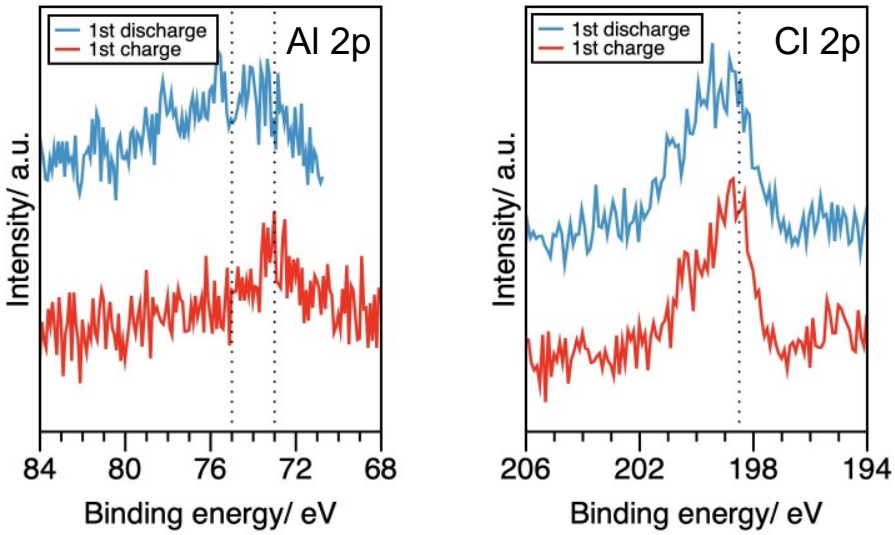

Figure S4. Biding energy of Al2p and Cl2p of $AlCl_3$-GIC (115) measured after 1st charge (lithiation) and 1st discharge (delithiation).

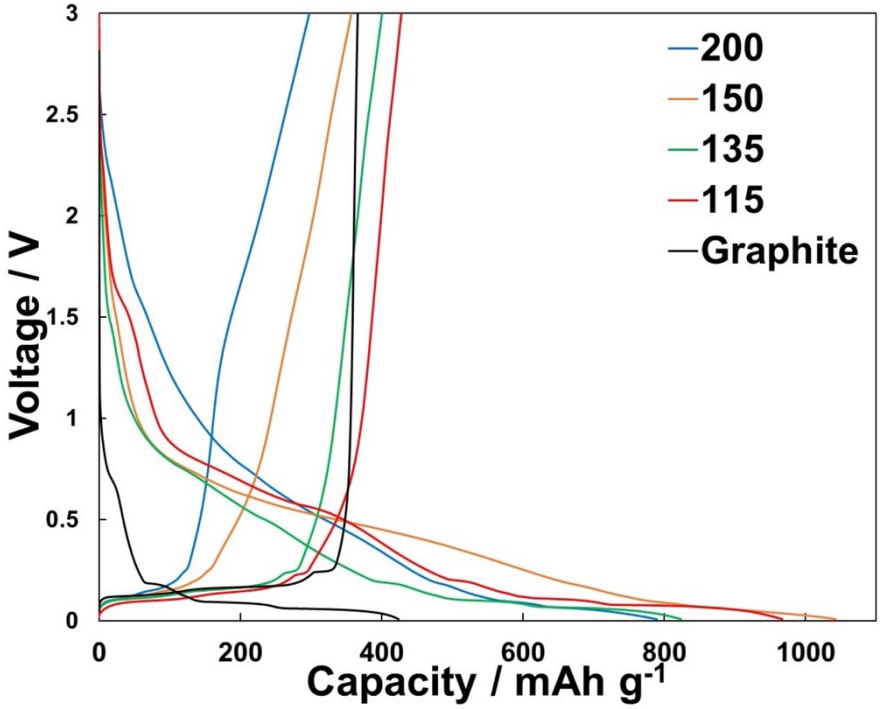

Figure S5. Initial charge/discharge curves cycled at 0.1 A g^{-1} in a voltage range of 0.01-3.0 V of a half-cell composed of graphite and $AlCl_3$-GICs (115, 135, 150, and 200).

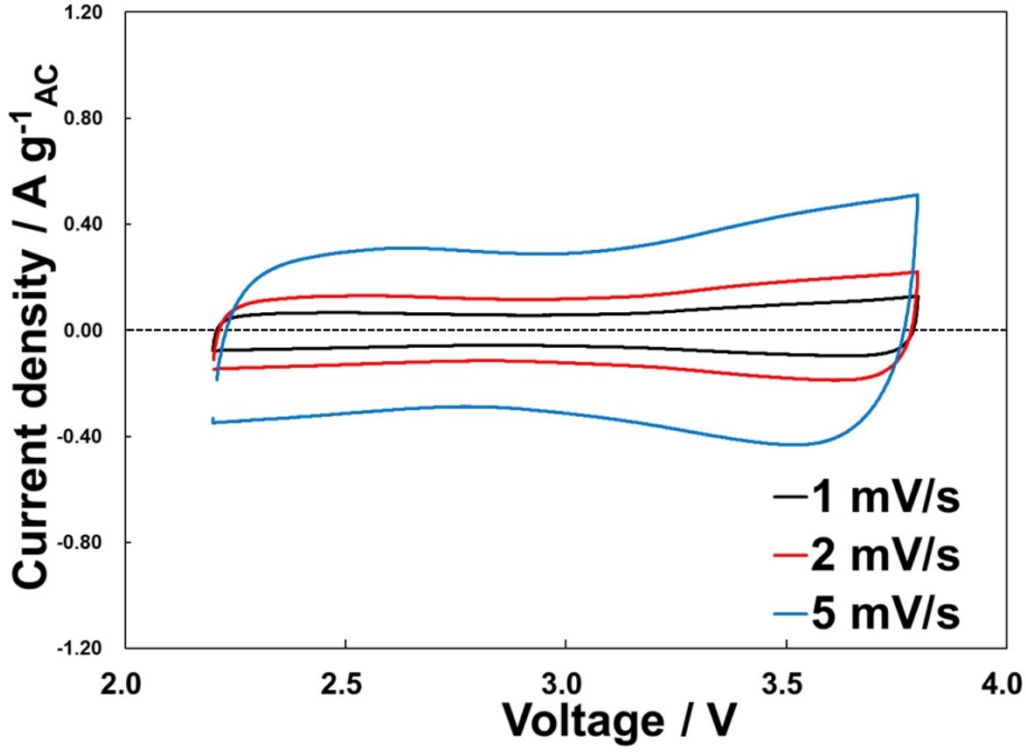

Figure S6. Cyclic voltammogram of LICs composed of $AlCl_3$-GICs (115) negative electrode after pre-lithiation and AC positive electrode with 3:1 capacity ratio. CV was obtained in the voltage range of 2.2-3.8 V at scan rates of 1.0, 2.0, 5.0 mV s^{-1}.

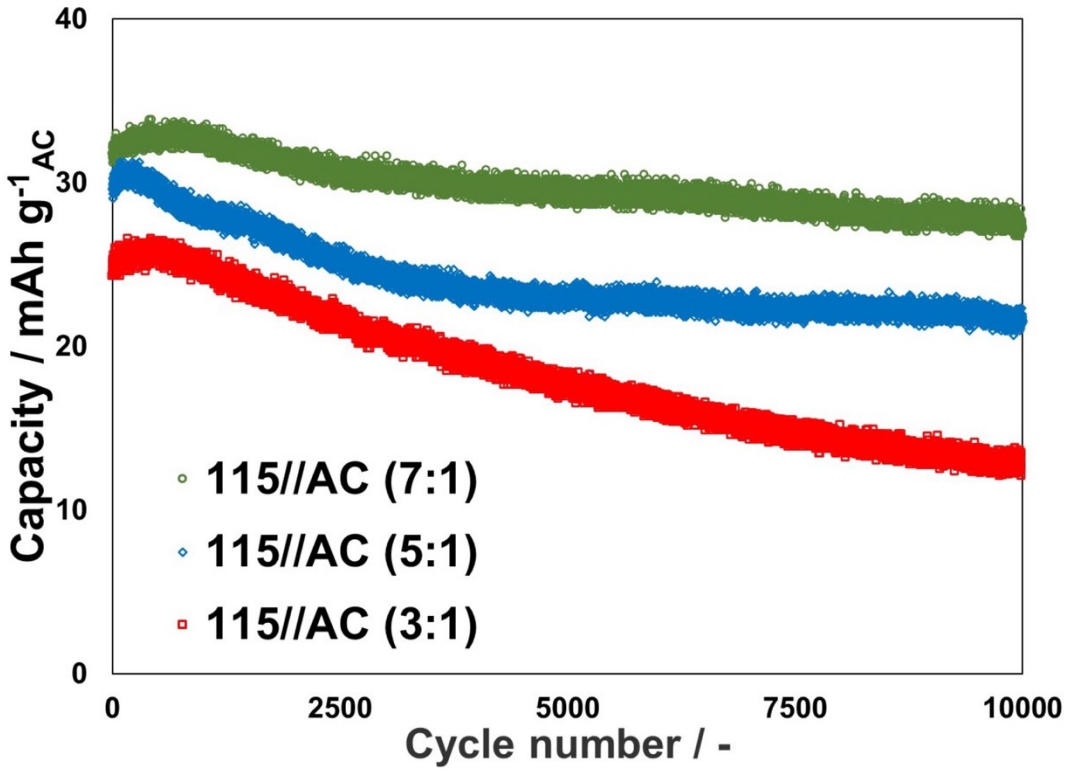

Figure S7. Discharge capacity cycled at 1.0 A g^{-1} of LICs composed of $AlCl_3$-GICs (115) negative electrode after pre-lithiation and AC positive electrode with capacity ratios of 3:1, 5:1, and 7:1. Charge/discharge test was carried out in a voltage range of 2.2-3.8 V at a current density of 1.0 A g^{-1}_{AC}.