Supporting Information

Upcycling sodium lignosulfonate into carbon anode with an inorganic-rich interphase by potential regulation for lithium-ion batteries

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Correlated Calculations:

$$i(V) = av^b \qquad Eq.S1$$

$$Log\ (i) = log\ (a) + blog\ (v) \qquad Eq.S2$$

where i represents the peak current, v denotes the scan rate, a is a constant, and b signifies the slope of the line as a function of $log(i)$ and $log(v)$.

$$i = k_1 v + k_2 v^{0.5} \qquad Eq.S3$$

where $k_1 v$ stands for the current response contributed by the pseudo capacitive process, and $k_2 v^{0.5}$ represents for the diffusion-controlled portion of the current response.

$$D = \frac{4}{\pi\tau} \cdot \left(\frac{n_m . V_m}{S}\right)^2 \cdot \left(\frac{\Delta E_s}{\Delta E_\tau}\right)^2 = \frac{4}{\pi\tau} \cdot \left(L\frac{\Delta E_s}{\Delta E_\tau}\right)^2 \qquad Eq.S4$$

Where τ is the relaxation time; n_m (mol) is the number of moles of the active material; V_m ($cm^3\ mol^{-1}$) is the molar volume; S (cm^2) is the contact area between the active material with the elctrolyte; ΔE_S (V) is the change in voltage induced by the pulses; and ΔE_τ (V) is voltage variation under constant current puls; L is the average migration path length for lithium ions within the active material particles

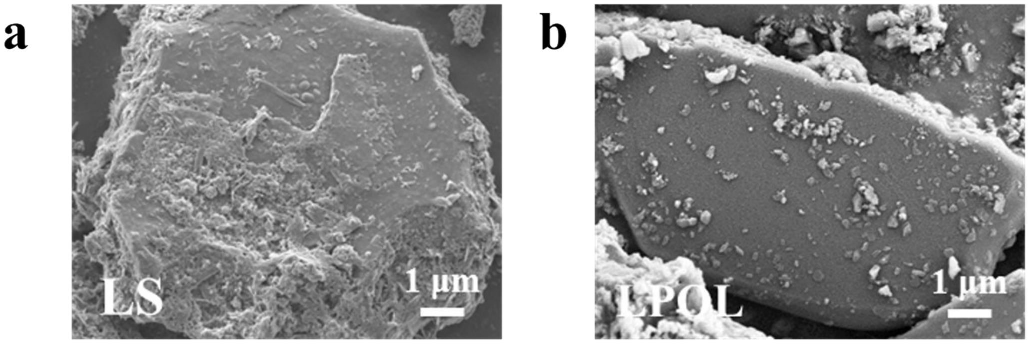

Fig. S1. (a) SEM image of the pristine LS powders; (b) SEM image of the fabricated LPOL powders.

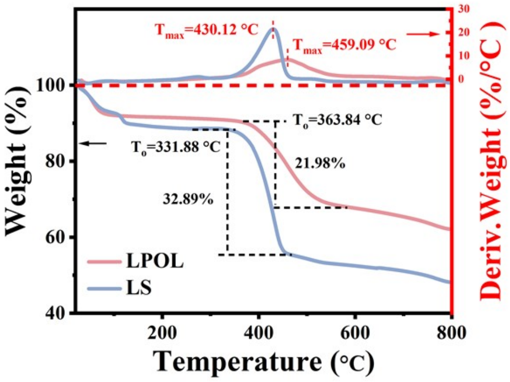

Fig. S2 TG-DTG curve of the two samples.

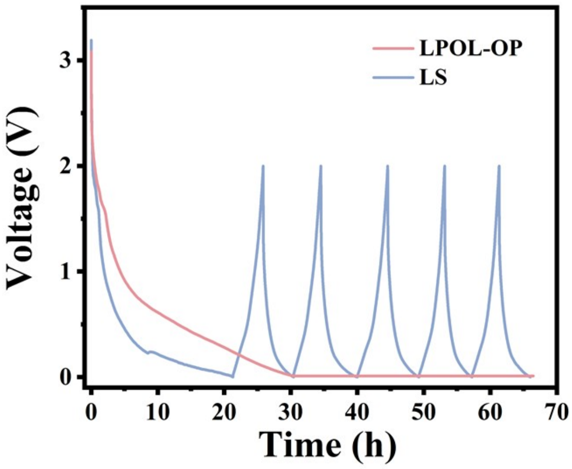

Fig. S3. Potential change during SEI formation process using continuous galvanostatic charge-discharge (CGCD) method.

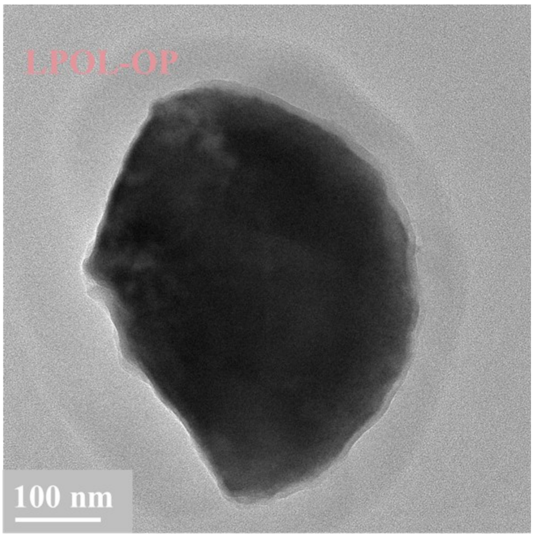

Fig. S4. HRTEM images of LPOL-OP anode;

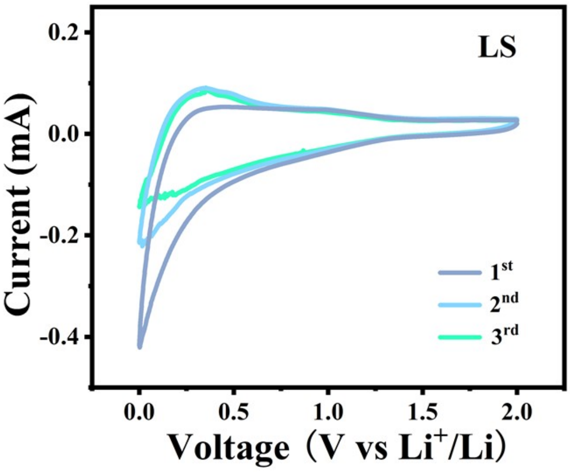

Fig. S5. The CV curves of LS electrodes in initial three cycles at 0.2 mV s^{-1}

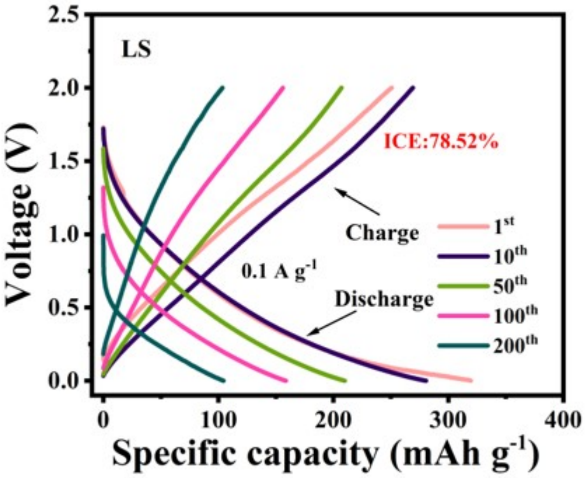

Fig. S6. Charge-discharge curves of LS after different cycles at 100 mA g^{-1}.

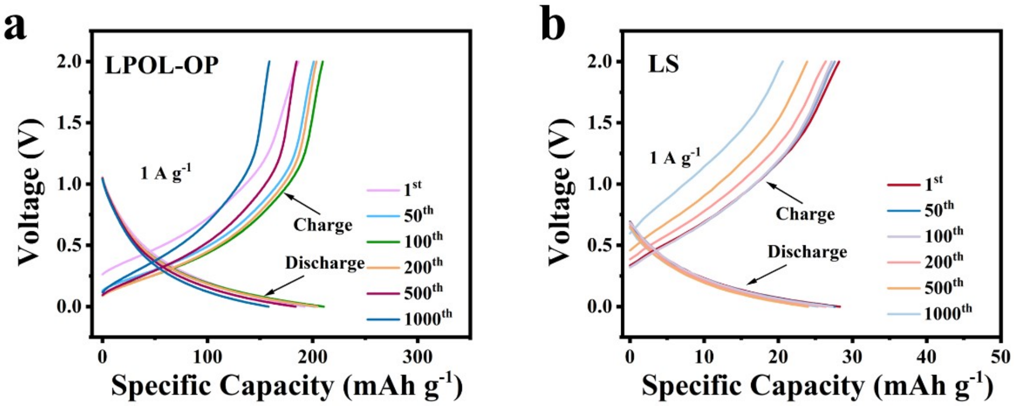

Fig. S7. (a) Charge-discharge curves of LPOL-OP after different cycles at 1000 mA g^{-1}; (b) Charge-discharge curves of LS after different cycles at 1000 mA g^{-1}.

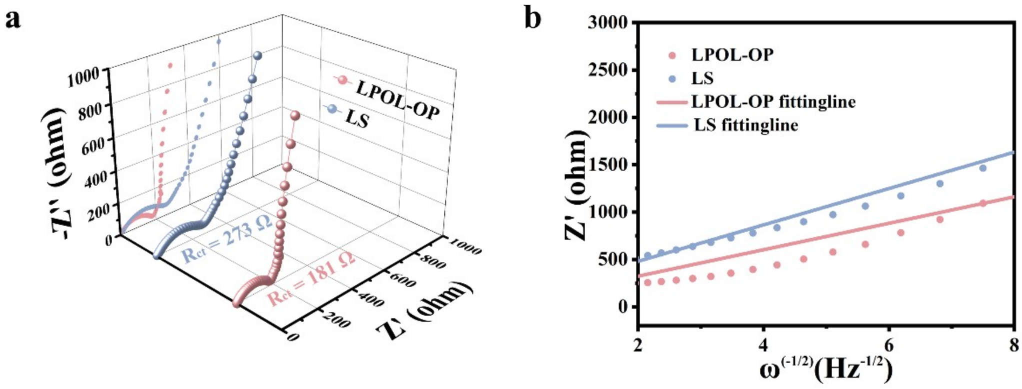

Fig. S8. (a) EIS of the LPOL-OP and LS; (b) Linear fitting of inclined line at low frequency.