

## Supporting Information

### Sustainable upcycling of waste low-density polyethylene droppers into active materials for lithium-ion hybrid capacitors

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(S. K. Martha)

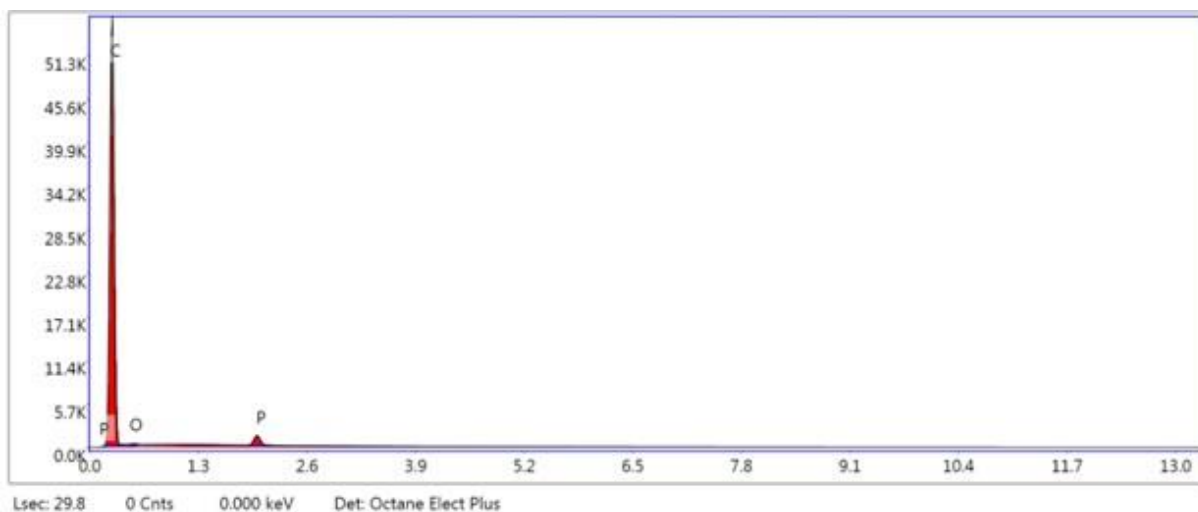


Figure S1. EDS spectrum of LDPE-PHC.

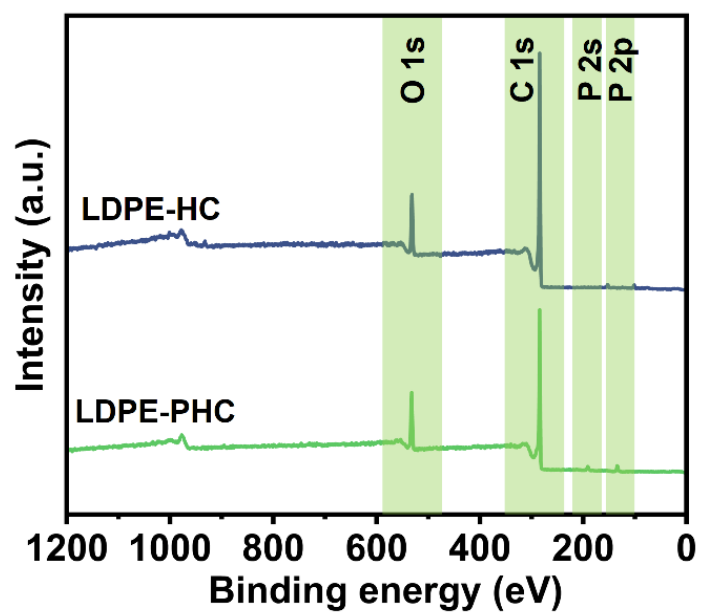


Figure S2. XPS survey spectra of LDPE-HC and LDPE-PHC.

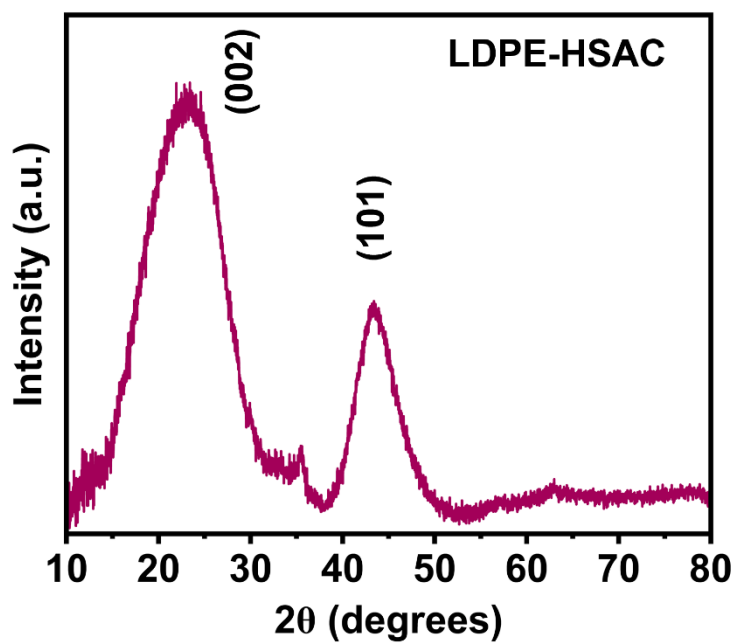


Figure S3. XRD of LDPE HSAC.

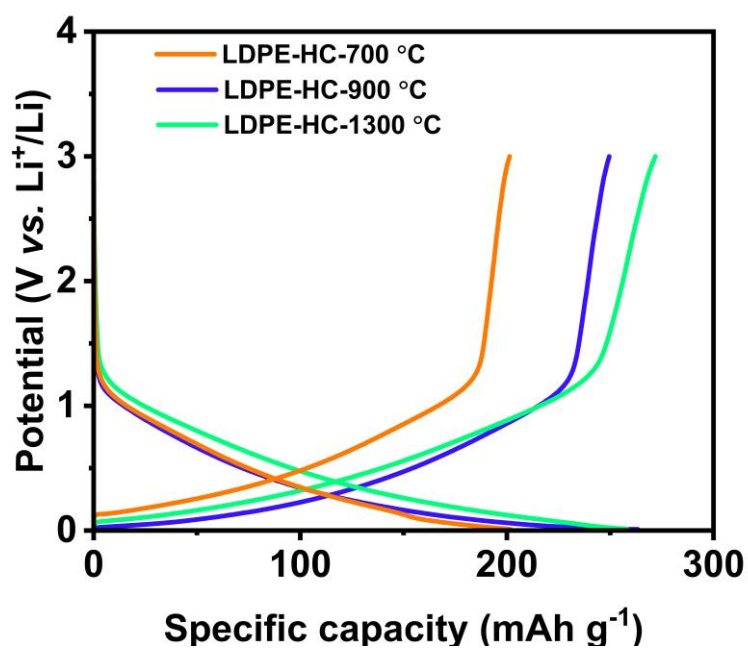


Figure S4. Second cycle GCD plots of LDPE-HC synthesised at 700 °C, 900 °C and 1300 °C.

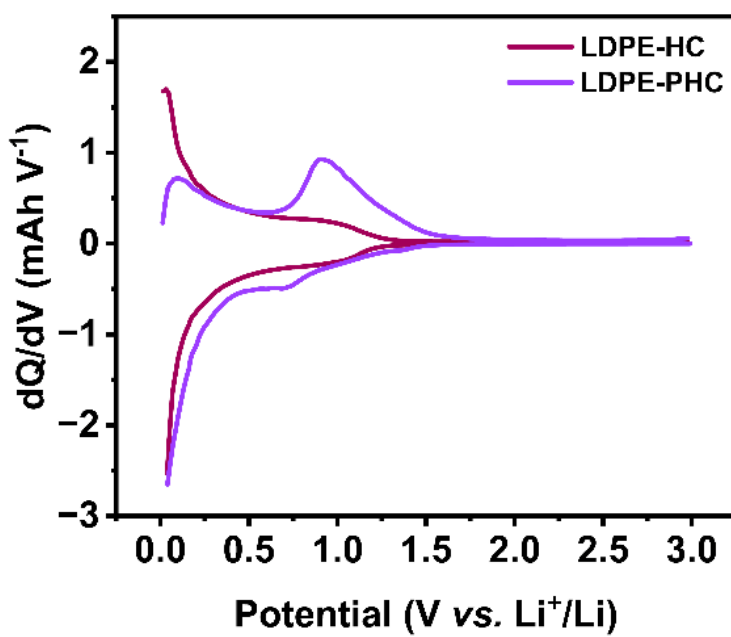


Figure S5. Differential capacity plots of LDPE-HC and LDPE-PHC.

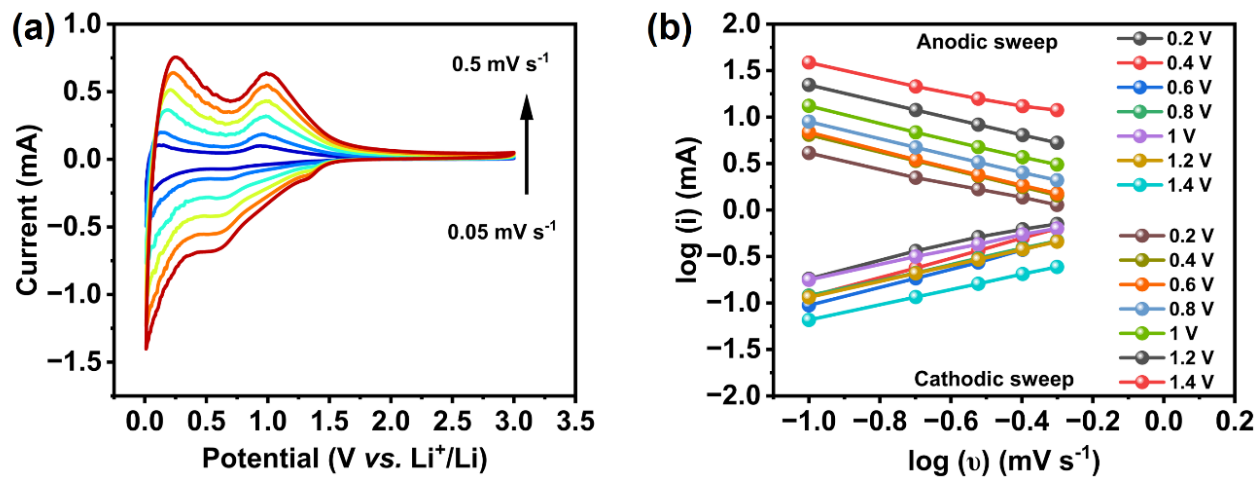


Figure S6. (a) CVs of LDPE-PHC at various scan rates (0.05, 0.1, 0.2, 0.3, 0.4 and 0.5  $\text{mV s}^{-1}$ ). (b)  $\log(v)$  and  $\log(i)$  plots at different voltages for b-value analysis.

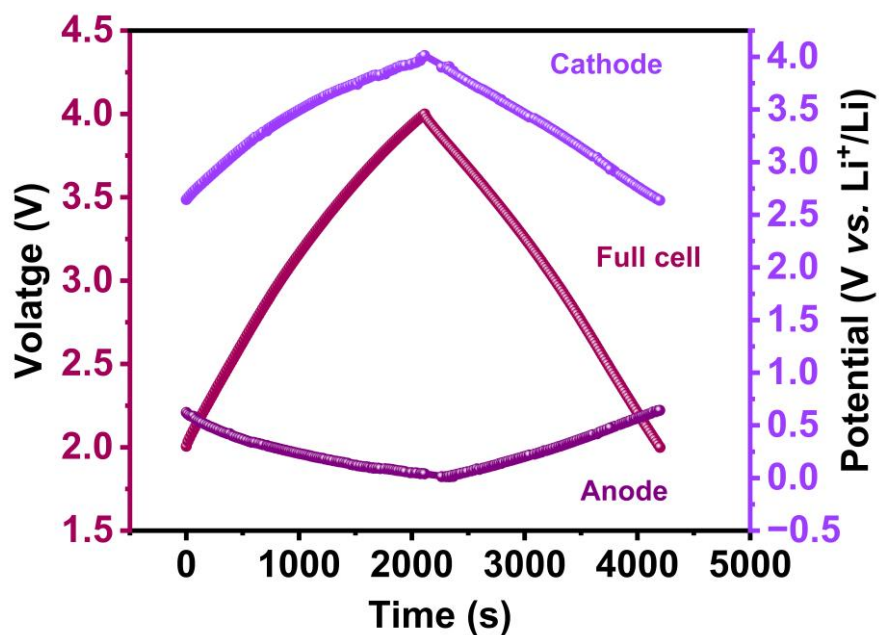


Figure S7. GCD three-electrode analysis of the LIC full cell and the individual anodic and cathodic potentials.

Table T1. Comparison of LDPE-PHC||LDPE-HSAC LIC performance metrics of existing literature.

LIC configuration	Voltage window(V)	Energy density (Wh kg <sup>-1</sup> )	Power density (kW kg <sup>-1</sup> )	Cyclic stability
Li <sub>4</sub> Ti <sub>5</sub> O <sub>12</sub>   LiNi <sub>0.5</sub> Mn <sub>1.5</sub> O <sub>4</sub> <sup>1</sup>	1.5-3.5	48	7.9	70% for 4000 cycles
Bio-waste carbon anode and activated carbon cathode <sup>2</sup>	1.5-4	120	20.7	67% for 9000 cycles
TiO <sub>2-x</sub> -C  activated carbon <sup>3</sup>	1-4	77.6	0.25	54.3% for 1000 cycles
Graphite-Si  Activated carbon <sup>4</sup>	2-4	91.9	0.03	87.2% for 1000 cycles
Hard carbon-Graphite-Si composite anode  Activated carbon <sup>5</sup>	2-4	129.3	6.8	88.4% for 1000 cycles
CNT/rGOR symmetric device <sup>6</sup>	0.1-4.5	213	0.45	87.1% for 1000 cycles
Holey Ti <sub>3</sub> C <sub>2</sub>   Activated carbon <sup>7</sup>	0.1-4.2	110	4.6	80% for 2000 cycles
B/N/O-Codoped 2D Porous Carbon Nanosheets symmetric device <sup>8</sup>	0.01-4.5	173.1	0.22	79% for 1000 cycles
LDPE-PHC  LDPE-HSAC	2-4	115.9	6	85.8% for 7000 cycles at 1 A g <sup>-1</sup>

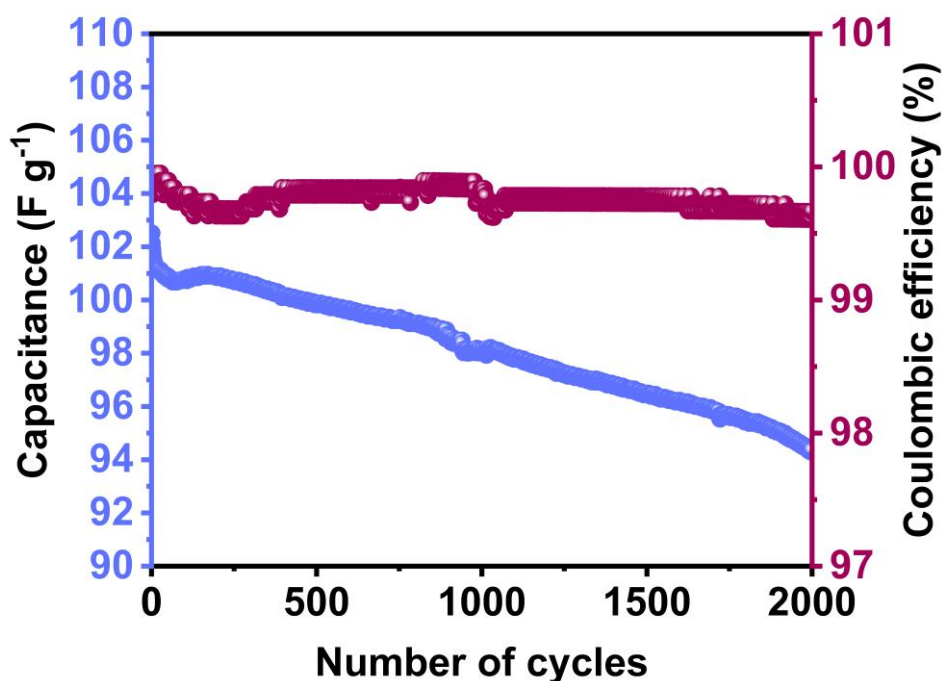


Figure S8. Discharge capacity and coulombic efficiency of LDPE-PHC||LDPE-HSAC at high temperature of 50 °C.

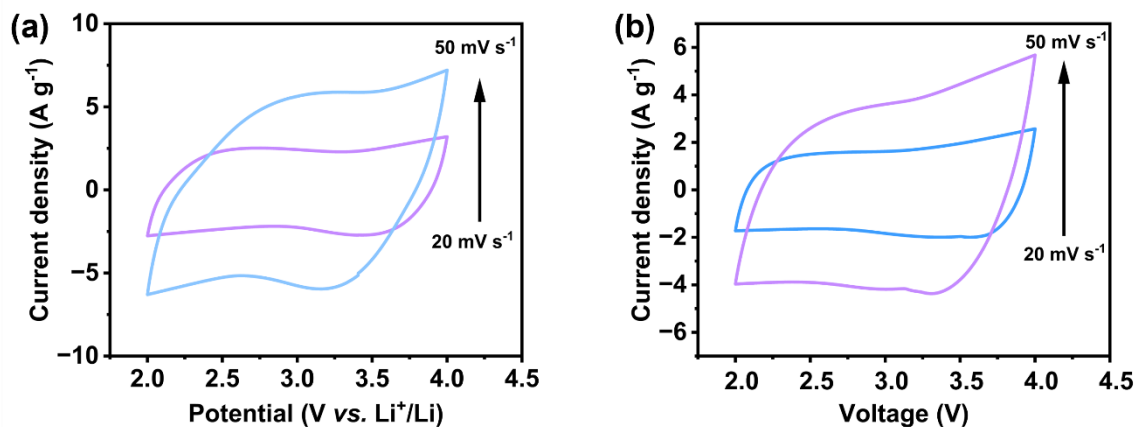


Figure S9. CVs of (a) LDPE-HSAC and (b) LDPE-PHC||LDPE-HSAC at 20 and 50 mV s<sup>-1</sup>.

#### References:

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