Supporting information

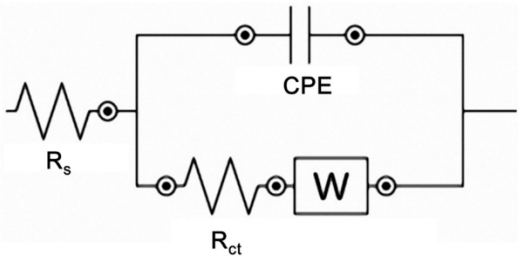

Figure S1 Electrical equivalent circuit models for fitting the EIS response of the electrodes, where R_s is the solution resistance, R_{ct} represents the charge transfer resistance, and the CPE represents the double layer capacitance.

Notes: The Nyquist plots were obtained at open circuit potential condition, which are divided into two parts: (1) the semicircle in the high frequency is related to the charge transfer resistance (R_{ct}), (2) the linear in the low frequency is associated with Warburg impedance (Z_w), which could reveal the diffusion coefficient of Li^+. The σ values can be calculated according to the equation (S1):

$$Z_w = Z' + Z'' = \sigma\omega^{-1/2} - j\sigma\omega^{-1/2} \quad \text{(S1)}$$

where, $\sigma\omega^{-1/2}$ belongs to real part (Z'), $-j\sigma\omega^{-1/2}$ represents imaginary part of impedance (Z''), and Z_w is the Warburg impedance.

The relationships between σ and Li^+ diffusion coefficients (D_{Li^+}) are following the equation (S2):

$$\sigma = \frac{RT}{n^2F^2}\frac{1}{\sqrt{2D_{Li} + C_0}} \quad \text{(S2)}$$

where, R is the gas constant (8.314 J mol^{-1} K^{-1}), T is the Kelvin temperature (293.15 K), n is the electronic transfer number, F is the Faraday constant (96485 C mol^{-1}), and C_o is the concentration of Li^+.

Table S1 The relative atomic content of C, O and F at the graphite electrode by applying different electrolytes after 10th cycle.

Electrolytes	C (at.%)	O (at.%)	F (at.%)
BE	95.24	3.95	0.81
BE-FH52	98.10	1.22	0.69
BE-FH54	97.44	1.96	0.60
BE-FH56	99.04	0.64	0.32

Table S2 Comparison of different additives applied to graphite anode of LiBs on the performance, toxicity/environmental and costs implications.

Additives	Capacity at 0.1 C	Ref.	Security/Environment	Costs
HTCN/FEC	296.16 mAh/g after 60th cycle	This work	Microtoxicity	0.15 $ /g
FEC	341 mAh/g after 35th cycle	[1]	Toxic	0.21 $ /g
VC	275 mAh/g after 50th cycle	[2]	Water Pollution	1.15 $ /g
ADN	160 mAh/g after 160th cycle	[3]	Toxic	0.48 $ /g
TMP	332 mAh/g after 50th cycle	[4]	Flammable	0.16 $ /g
TAP	110 mAh/g after 160th cycle	[5]	Toxic	42.48 $ /g

References

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