Electronic Supplementary Information (ESI)

Glyme-Li salt equimolar molten solvates with iodide/triiodide redox anions

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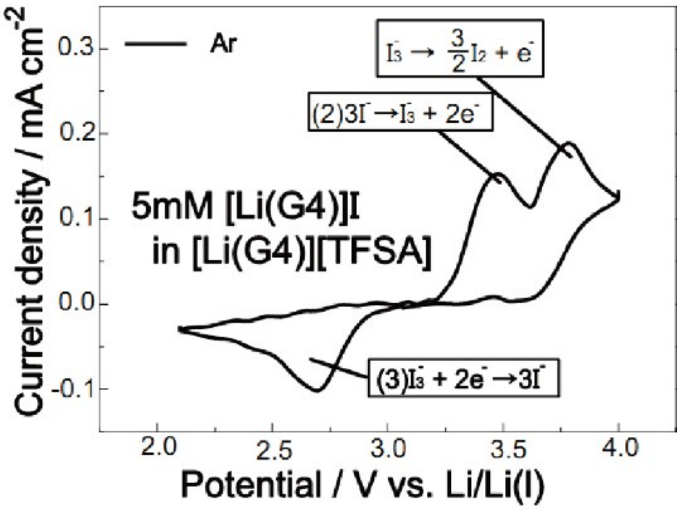

Fig. S1 Cyclic voltammogram on Pt disk electrode of at a scan rate of 10 mV s^{-1} in [Li(G4)][TFSA] containing 5 mM [Li(G4)]I. Reference electrode: Li/Li$^+$ in 1M LiTFSA in G4 solution.

Chemical diffusion coefficient of anions and ionicity

The limiting current value ($|I_{\mathrm{lim}}|$) are defined in eq. S1. The chemical diffusion coefficient was obtained by substituting the current value for the following:

$$|I_{\mathrm{lim}}| = 4nFcDr_0 \qquad \text{(S1)}$$

where n denotes the number of electrons, F for Faraday constant, c for concentration of an anion, D for chemical diffusion coefficient and r_0 for disk electrode radius.

The molar conductivity ratio (iconicity, $\Lambda/\Lambda_{\mathrm{NE}}$) was calculated by dividing the ideal ionic conductivity (Λ_{NE}) into the experimental one (Λ). Finally, these values are summarised in **Table S1**.

Table S1 Diffusion coefficients, molar conductivities and ionicity of [Li(G4Et)]I and [Li(G4Et)]I_3 at 60 °C.

Sample	D_G [10^{-7} cm^2 s^{-1}]	D_{Li} [10^{-7} cm^2 s^{-1}]	D_{anion} [10^{-7} cm^2 s^{-1}]	Λ [S cm^2 mol^{-1}]	Λ_{NE} [S cm^2 mol^{-1}]	$\Lambda/\Lambda_{\mathrm{NE}}$ [-]
[Li(G4Et)]I	0.86	0.76	4.36	0.46	1.73	0.27
[Li(G4Et)]I_3	4.46	4.87	2.84	2.89	2.61	1.11

Theoretical gravimetric capacity of catholyte.

Theoretical gravimetric capacity of catholyte (C_C) is given below:

$$C_C\ [\text{mAh g}^{-1}] = 100nF/3600M_C \qquad \text{(S2)},$$

where n indicates the number of moles relating to electron transfer, M_C for the total molecular weight of catholyte and F for Faraday constant. Thus, the capacity of [Li(G4Et)]I_3 was calculated to 85.91 mAh g^{-1}.

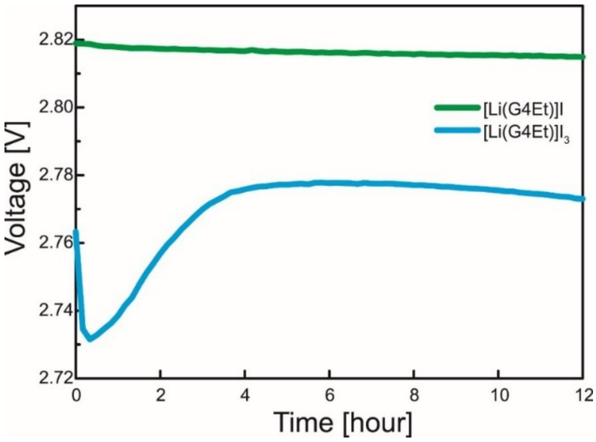

Fig. S2 Time-dependent cell voltage of [Li(G4Et)]I and [Li(G4Et)]I_3.

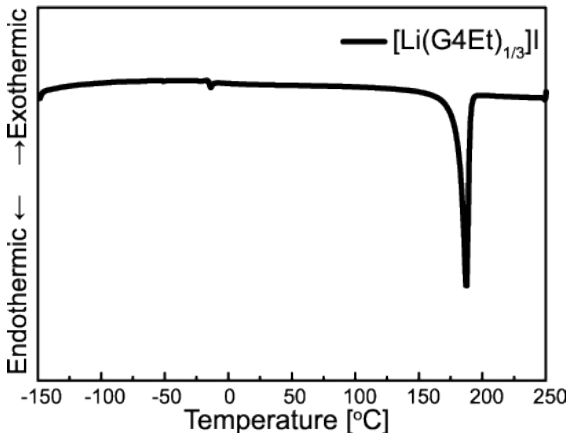

Fig. S3 DSC curve of [Li(G4Et)$_{1/3}$]I.

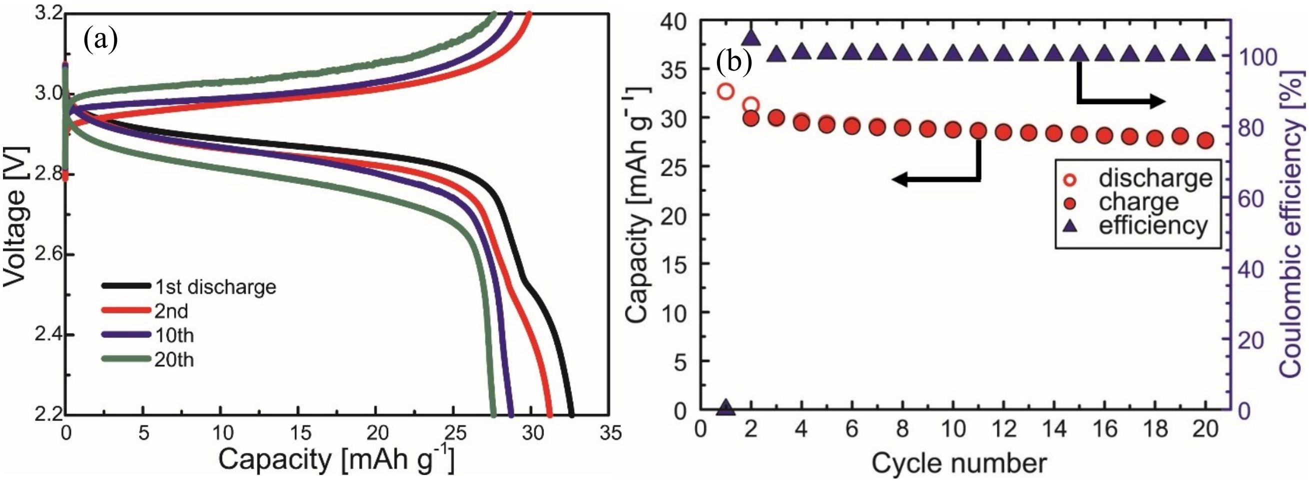

Fig. S4 (a) Charge-discharge curves of Li | 1 mol dm^{-3} Li[TFSA] in G4Et | LICGC | 1 mol dm^{-3} LiI_3 in G4Et cell at 60 °C. (b) charge-discharge capacity and Coulombic efficiency as a function of cycle number.