Electronic supplementary information

Tetrafluoroethylene telomers as electrolyte additives enable high-performance, radiation-tolerant lithium and potassium batteries

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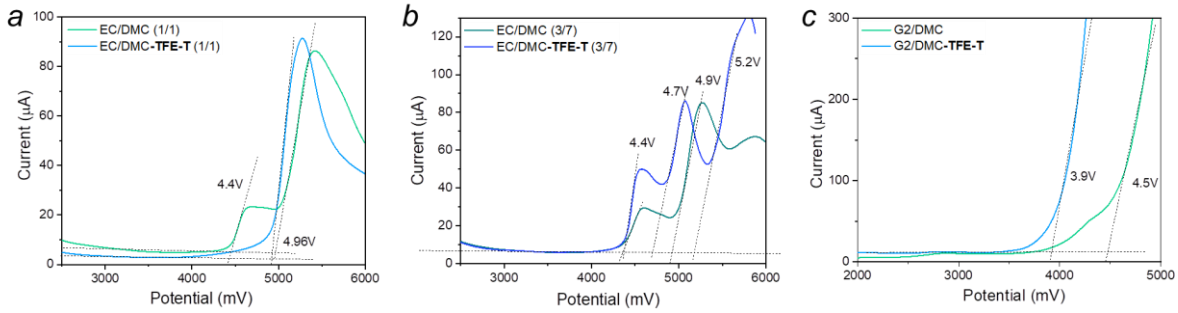

Figure S1. Anodic limits of the electrochemical stability window for the studied electrolytes determined using linear sweep voltammetry in symmetrical cells with two stainless steel electrodes: EC/DMC (1/1) and EC/DMC-**TFE-T** (1/1) (a); EC/DMC (3/7) and EC/DMC-**TFE-T** (3/7) (b); G2/DMC and G2/DMC-**TFE-T** (c).

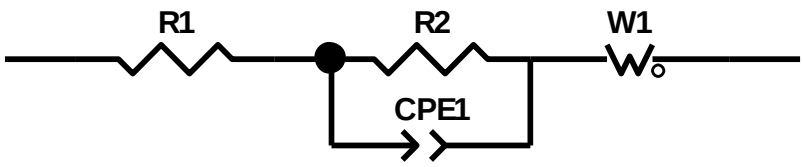

Figure S2. Equivalent circuit, where R1 is the resistance of the electrolyte, R2 is the resistance of the electrode/electrolyte interface, CPE1 is the constant phase angle element, W1 is the Warburg element.

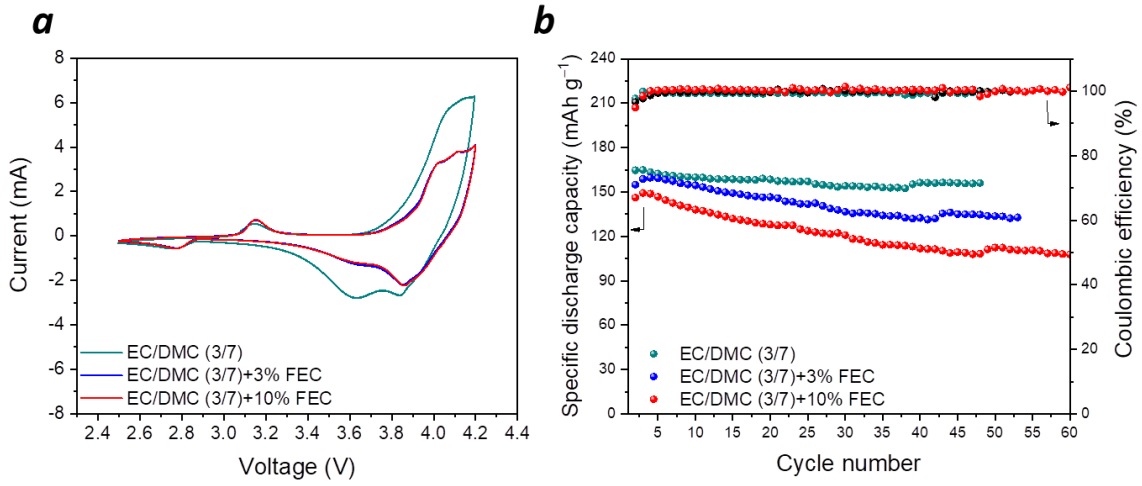

Figure S3. Cyclic voltammograms of the Li//NMC cells with standard electrolyte 1M $LiPF_6$ EC/DMC (3/7) and with 3, 10 % FEC additive (a) and cycling performance of the cells at 20 mA g^{-1} (b).

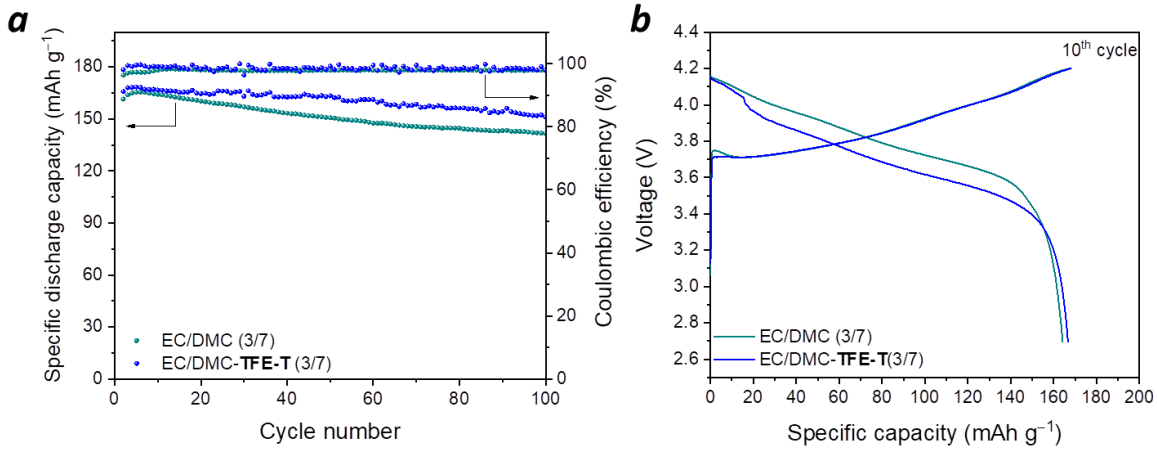

Figure S4. Cycling performance of the Li//NCA cells without and with **TFE-T** additive at 200 mA g^{-1} (a) and charge-discharge curves for the 10th cycle (b).

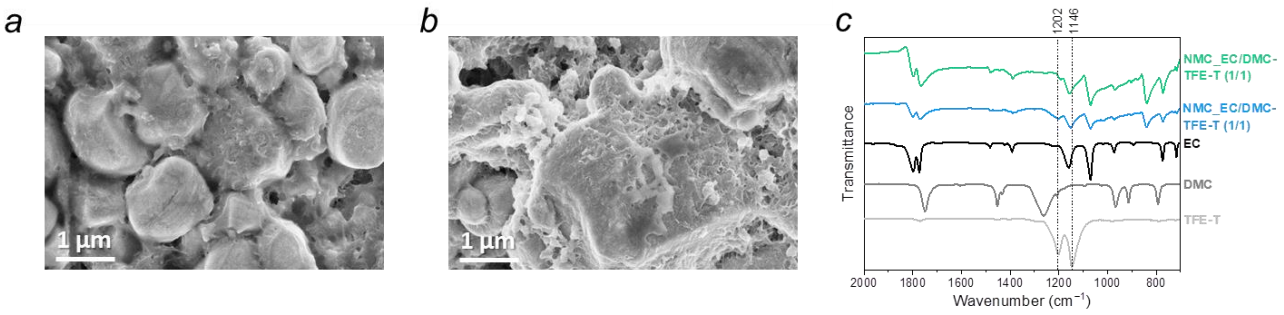

Figure S5. Li//NMC cells: SEM images of the cathodes after cycling in EC/DMC (1/1) (a) and EC/DMC-**TFE-T** (1/1) (b) electrolyte. FTIR spectra of the cathode after cycling (c).

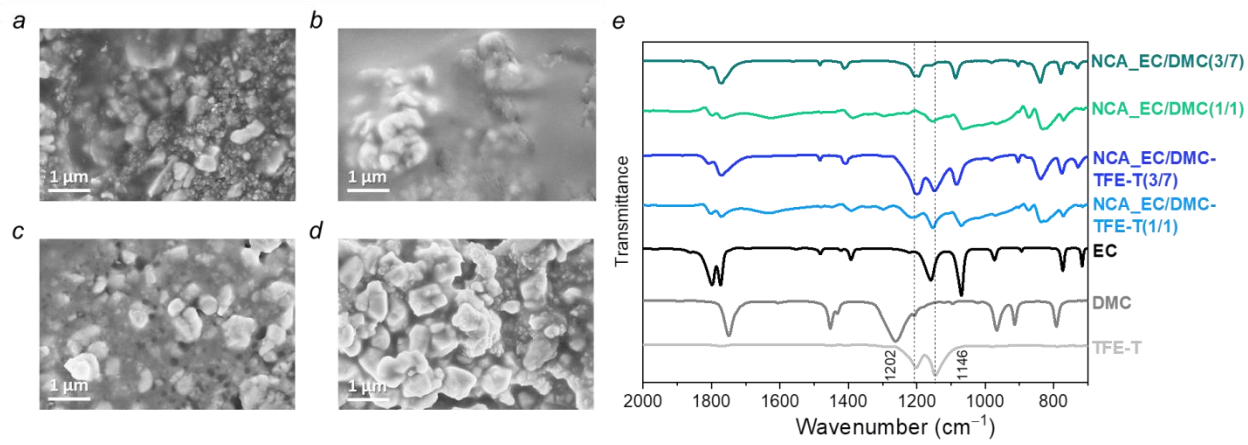

Figure S6. Li//NCA cells: SEM images of the cathodes after cycling in EC/DMC (1/1) (a) and EC/DMC-**TFE-T** (1/1) (b), EC/DMC (3/7) (c), EC/DMC-**TFE-T** (3/7). (d) FTIR spectra of cathodes after cycling (e).

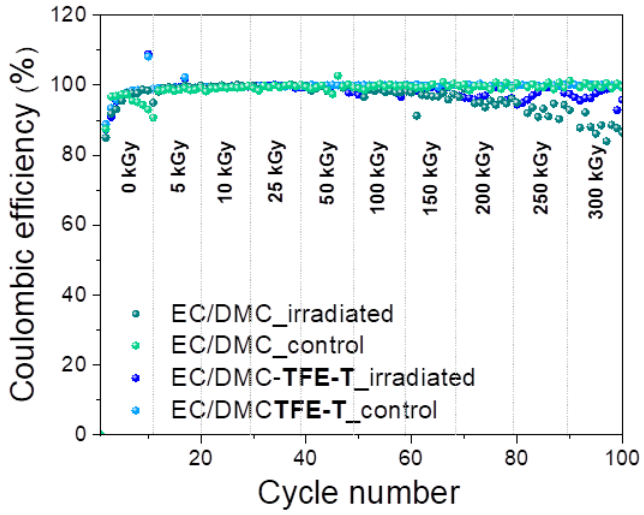

Figure S7. Coulombic efficiency of NCA//Li batteries assembled with and without **TFE-T** additive (Fig. 8). Current density: 20 mA g^{-1}.

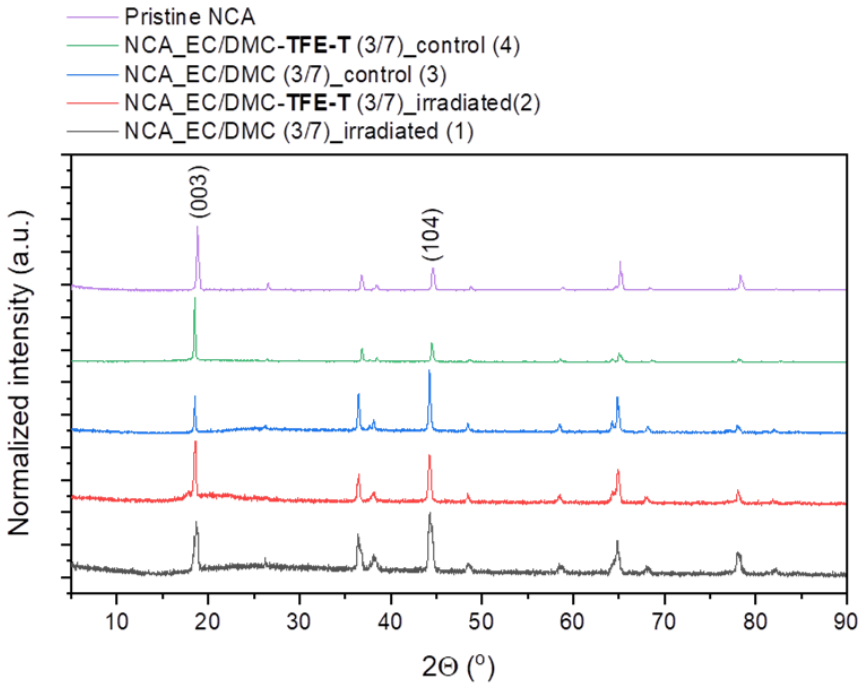

Figure S8. XRD patterns of NCA electrodes extracted from control and irradiated cells (300 kGy).

Table S1. XRD intensities of the (003) and (104) reflections, and the I(003)/I(104) intensity ratio for the NCA cathodes (from Fig. S8).

Name	**I (003)**	**I (104)**	**I (003)/I (104)**
pristine	1301	472	2.76
NCA _EC/DMC (3/7)_irradiated	429	510	0.84
NCA _EC/DMC-TFE-T (3/7)_irradiated	771	593	1.30
NCA _EC/DMC (3/7)_control	685	1122	0.61
NCA _EC/DMC-TFE-T (3/7)_control	2271	1059	2.14

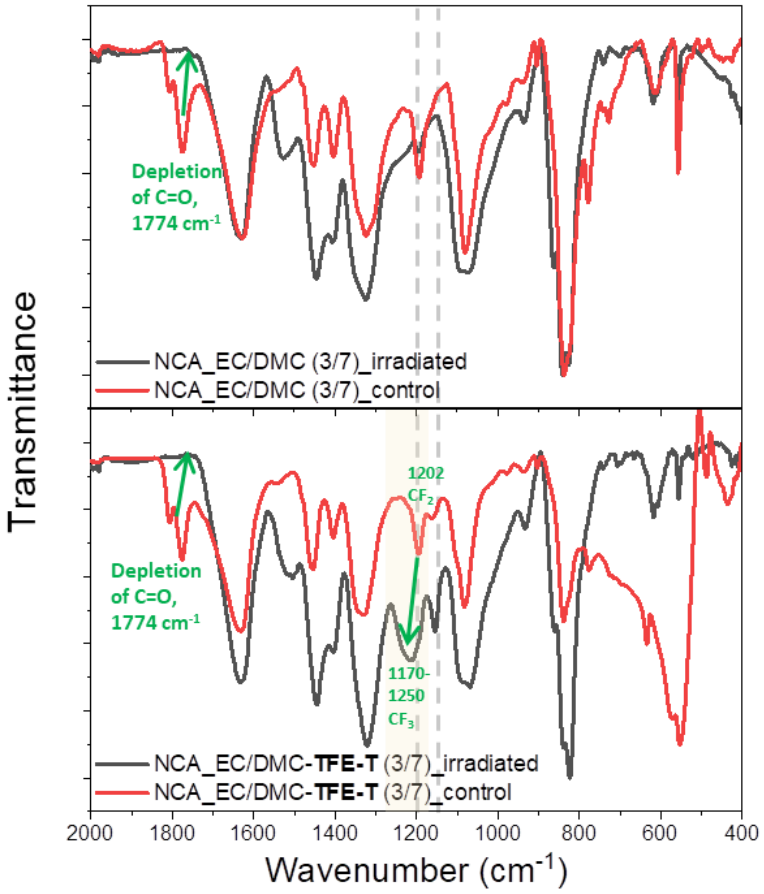

Figure S9. Comparison of the FTIR spectra for the NCA cathodes extracted from cells after irradiation (300 kGy) and control cells.

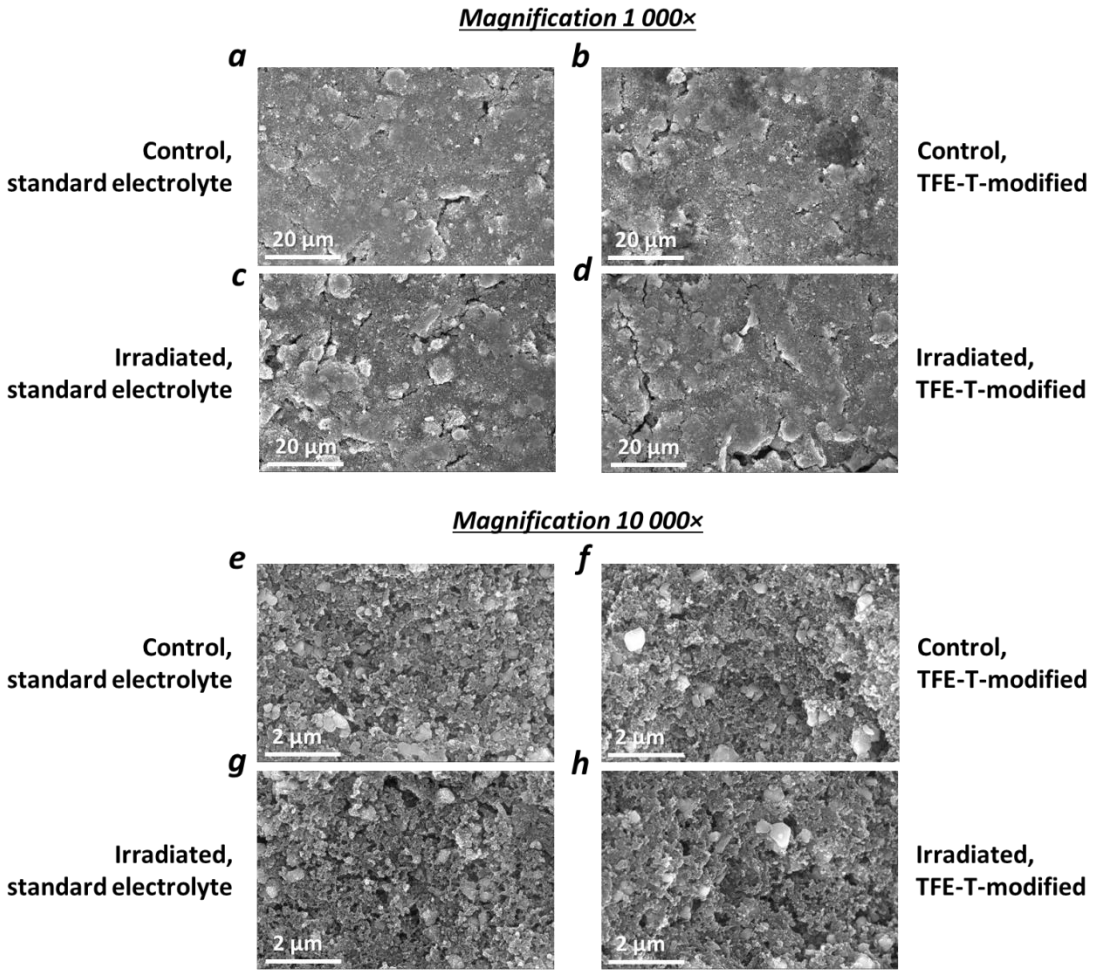

Figure S10. SEM images of NCA electrodes from non-radiated (control) cell using electrolytes: 1 M $LiPF_6$ EC:DMC (3:7 V:V) (a, e), 1 M $LiPF_6$ EC:DMC-TTE-F (3:7 V:V) (b, f) and from irradiated cell using electrolytes: 1 M $LiPF_6$ EC:DMC (3:7 V:V) (c, g), 1 M $LiPF_6$ EC:DMC-TTE-F (3:7 V:V) (d, h) (total dose: 300 kGy).