## Supplementary Information

# Improving Lithium-ion Cells by Replacing Polyethylene Terephthalate Jellyroll Tape

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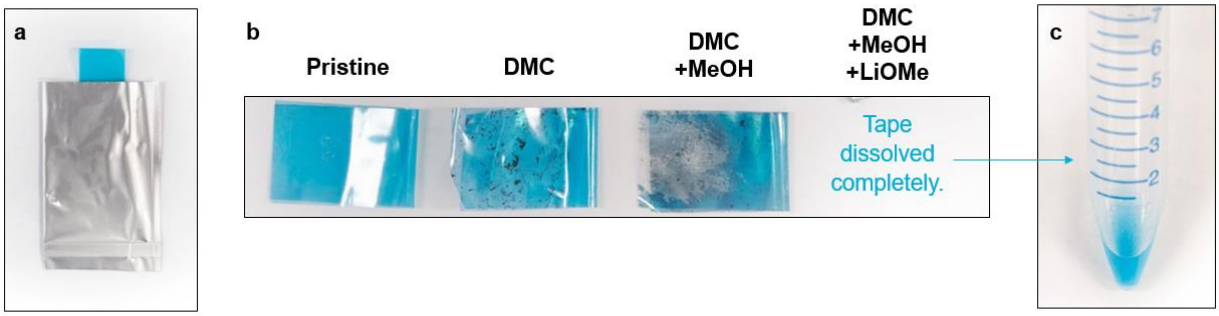
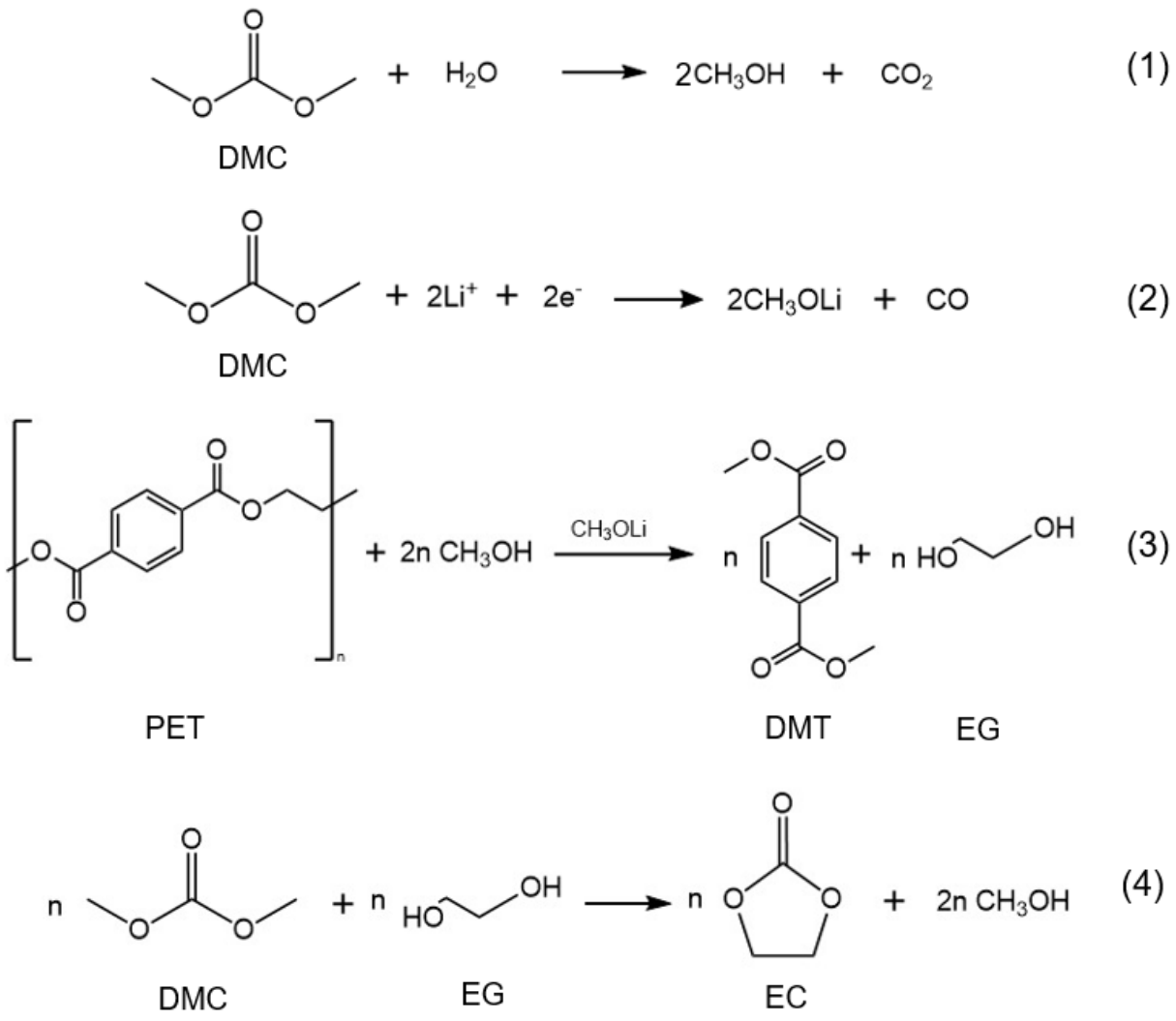
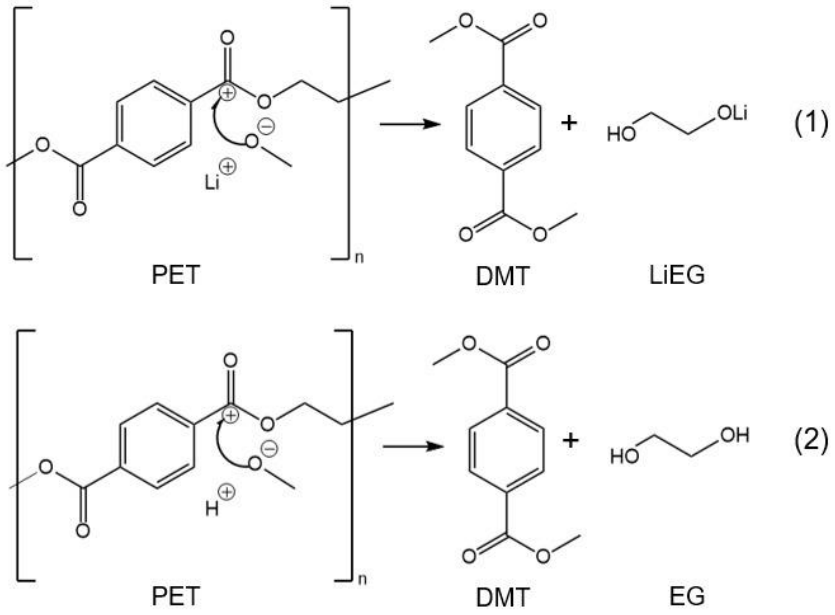


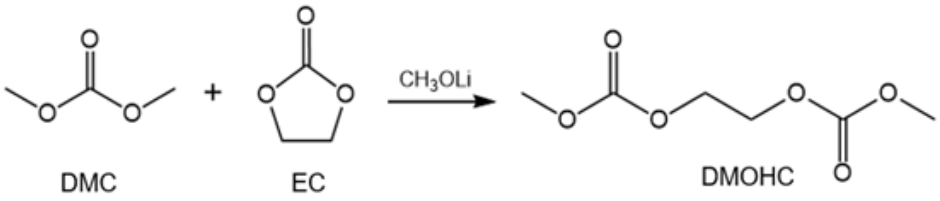

**Figure S1**. Pouch bags with blue PET tape (a) were filled with either DMC, DMC plus 10 wt% methanol, or DMC plus 10 wt% methanol and 2 wt% lithium methoxide. The tapes were inspected after keeping the pouch bags for 5 hours at 70 °C (b) and the liquid mixtures were extracted from the pouch bags. When DMC, methanol and lithium methoxide were used, the tape dissolved completely, and the liquid mixture turned blue (c).




**Scheme S1**. The reaction path for depolymerizing PET tape in battery cells. (1) DMC hydrolysis to methanol and $CO_2$; (2) DMC reduction to lithium methoxide and CO; (3) PET depolymerization via methanol and lithium methoxide into DMT redox shuttle and EC; (4) Reaction of DMC and EG to EC and methanol.




**Scheme S2.** (1) Depolymerization of PET via lithium methoxide, producing DMT and insoluble lithium ethylene glycolate, increasing the non-reversibility of the PET depolymerization. (2) Analogous reaction with methanol reacting with PET instead of lithium methoxide producing DMT and soluble EG.




**Scheme S3**. The reaction between DMC and EC (catalyzed by lithium methoxide) produces DMOHC.

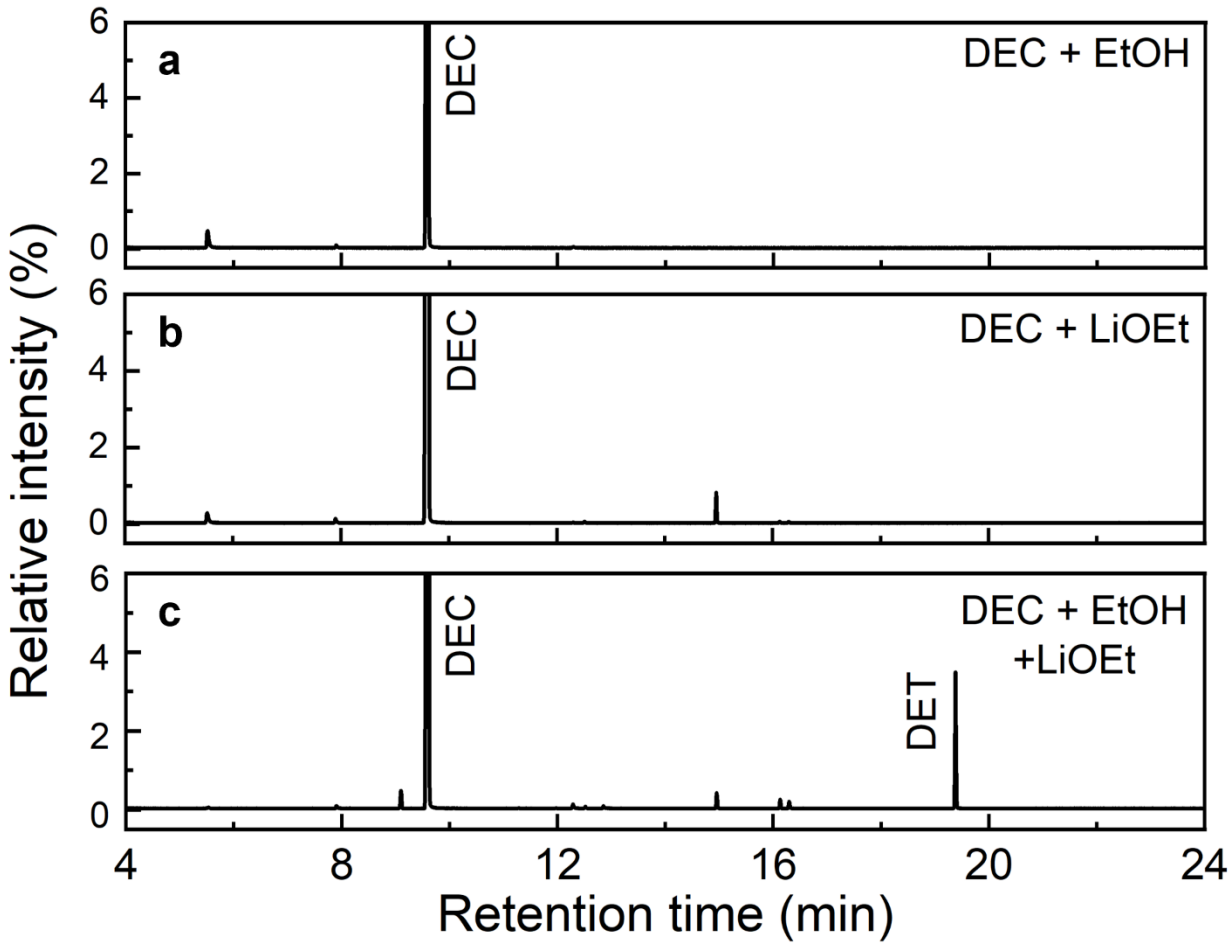
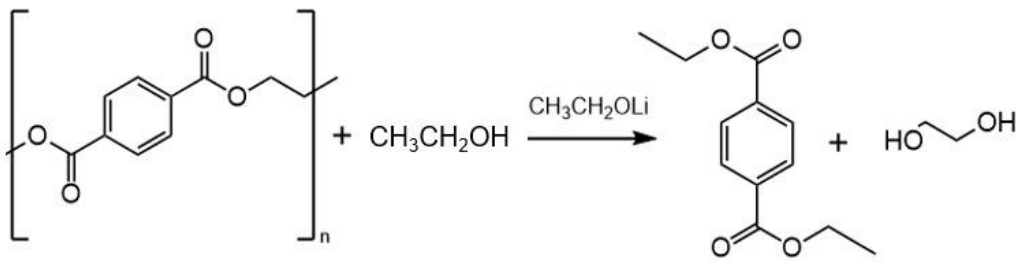
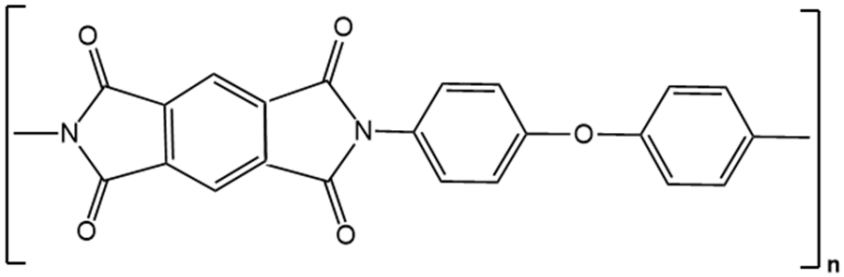


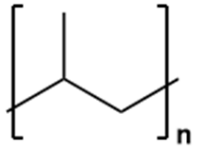

**Figure S2.** GC-MS spectra of liquid mixtures extracted from pouch bags kept at 70 °C for 5 hours with PET tape and either DEC and 10 wt% ethanol (a), DEC and 2 wt% lithium ethoxide (b), or DEC with 10% ethanol and 2% lithium ethoxide (c). PET is depolymerized only when all three reagents are added, and instead of dimethyl terephthalate, diethyl terephthalate is produced.



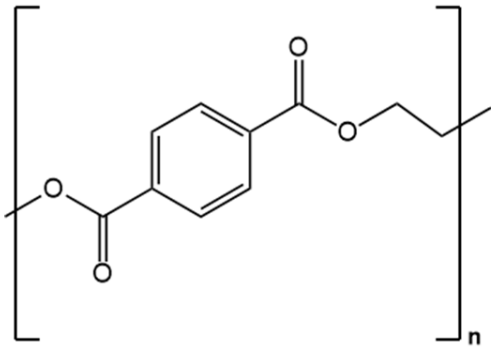

**Scheme S4**. Depolymerization of PET via ethanol and lithium ethoxide, producing diethyl terephthalate (DET) - an ethyl analog to the DMT redox shuttle, further proving the proposed reaction mechanism.



Polyimide (Kapton)



Polypropylene (PP)



Polyethylene terephthalate (PET)

**Scheme S5.** Chemical structures of polymers used in this study – polyimide (Kapton), polypropylene (PP), and polyethylene terephthalate (PET), respectively.