

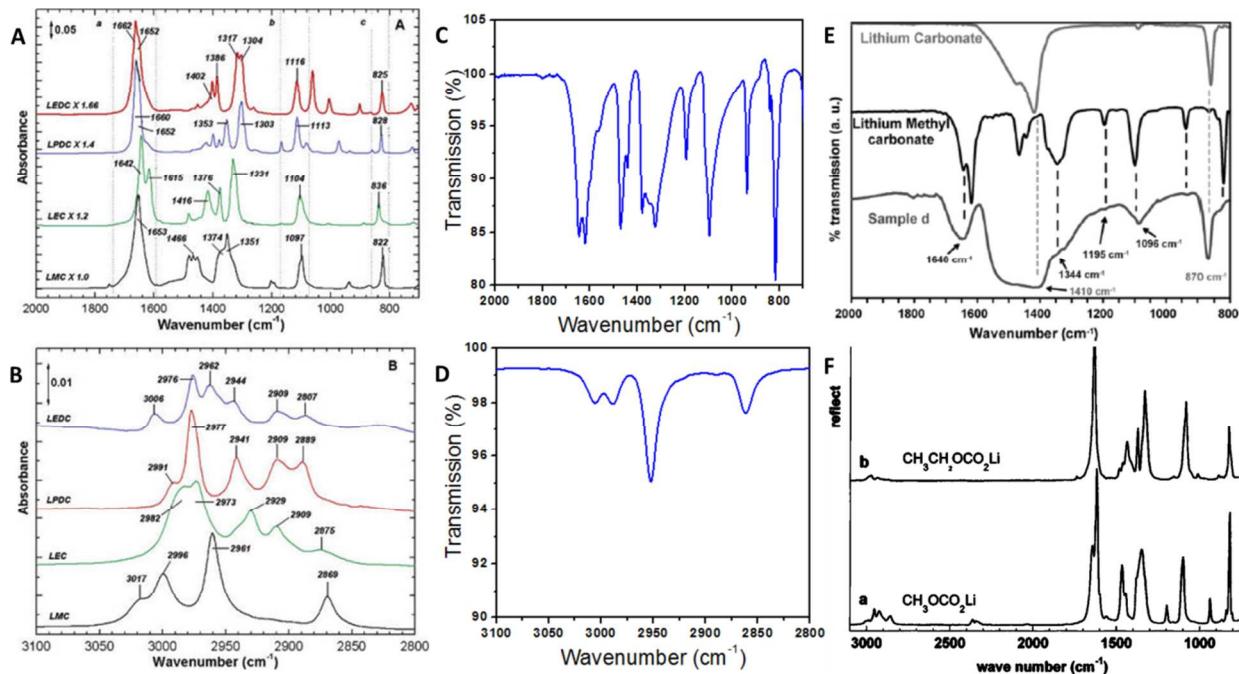
## Supporting Information

# Suppressing Lithium Dendrite Growth With A Single-Component Coating

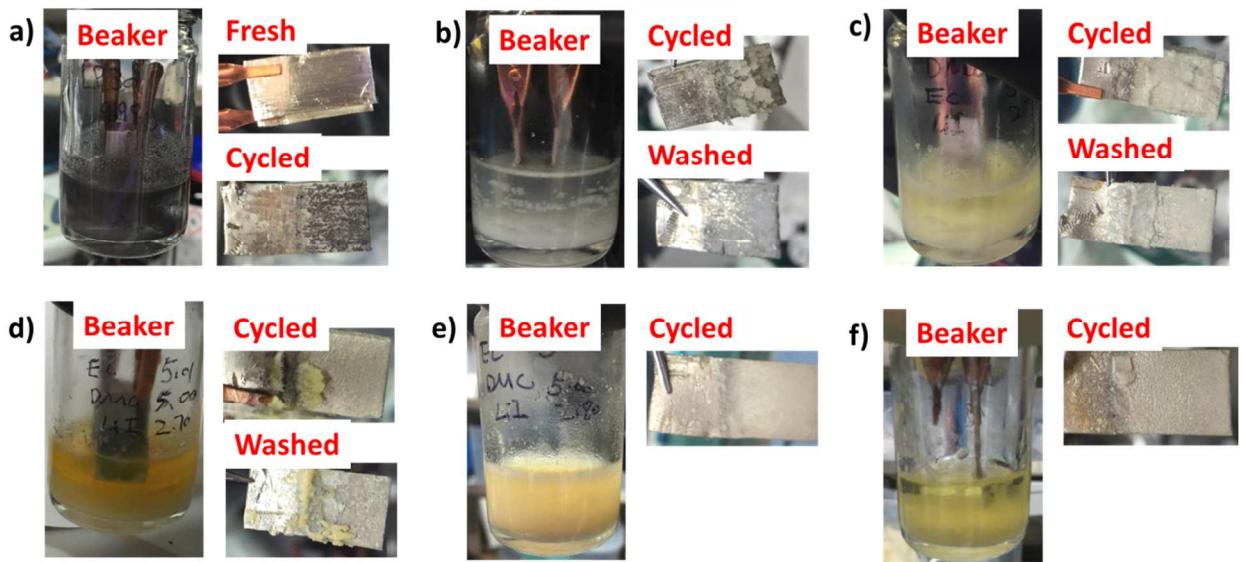
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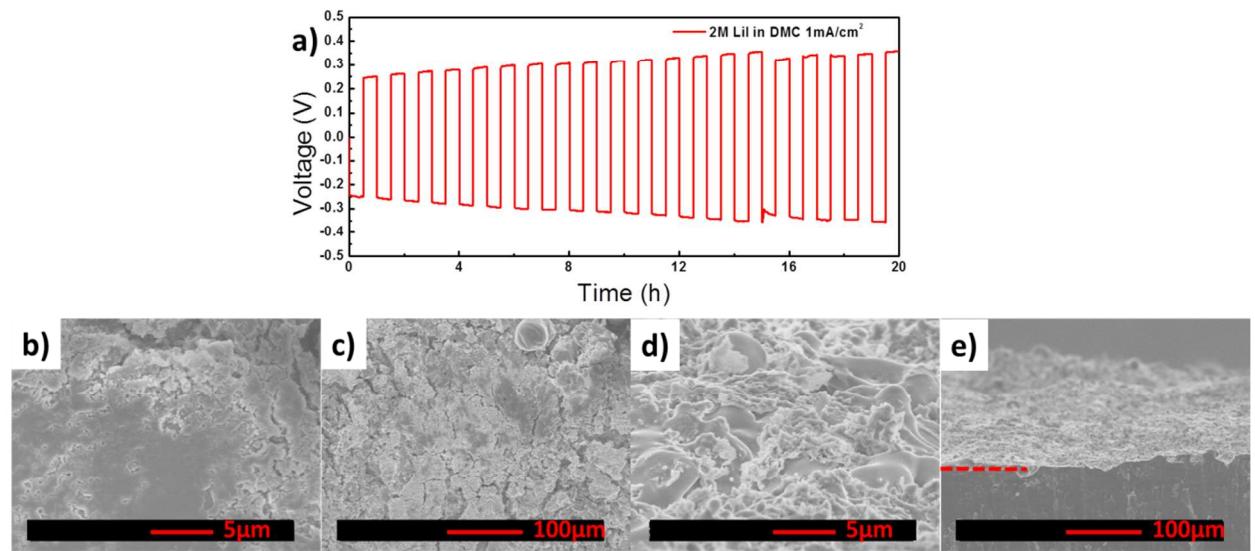
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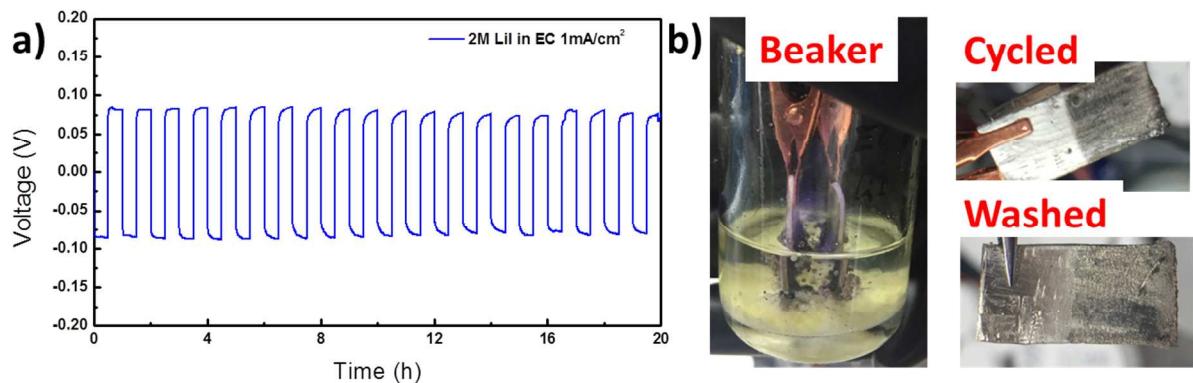
**Figure S1.** FTIR of lithium methyl carbonate, a), b) from reference 29,<sup>1</sup> c), d) experimental data from this work, e) from reference 27,<sup>2</sup> f) from reference 28.<sup>3</sup>



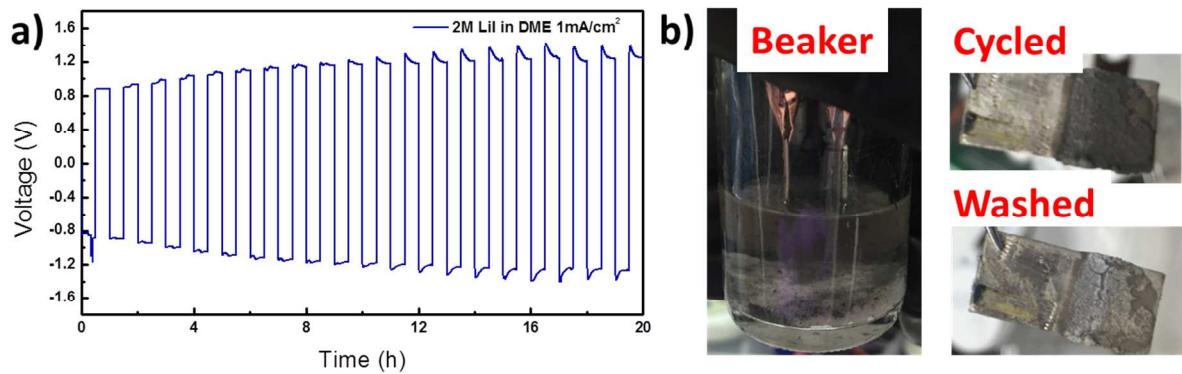
**Figure S2.** Optical images of the beaker and Li from the a) LP30 electrolyte cell after 20 cycles at  $1 \text{ mA cm}^{-2}$  for  $0.5 \text{ mAh cm}^{-2}$ ; b) LiI-DMC electrolyte cell after 20 cycles at  $1 \text{ mA cm}^{-2}$  for  $0.5 \text{ mAh cm}^{-2}$ ; c) LiI-EC/DMC electrolyte cell after 20 cycles at  $1 \text{ mA cm}^{-2}$  for  $0.5 \text{ mAh cm}^{-2}$ ; d) LiI-EC/DMC electrolyte cell after 300 cycles at  $3 \text{ mA cm}^{-2}$  for  $0.5 \text{ mAh cm}^{-2}$ ; e) LiI-EC/DMC electrolyte cell after 100 cycles at  $1 \text{ mA cm}^{-2}$  for  $1.5 \text{ mAh cm}^{-2}$ ; f) LMC saturated LP30 electrolyte cell after 100 cycles at  $1 \text{ mA cm}^{-2}$  for  $0.5 \text{ mAh cm}^{-2}$  (Li was coated with LMC before cycling).



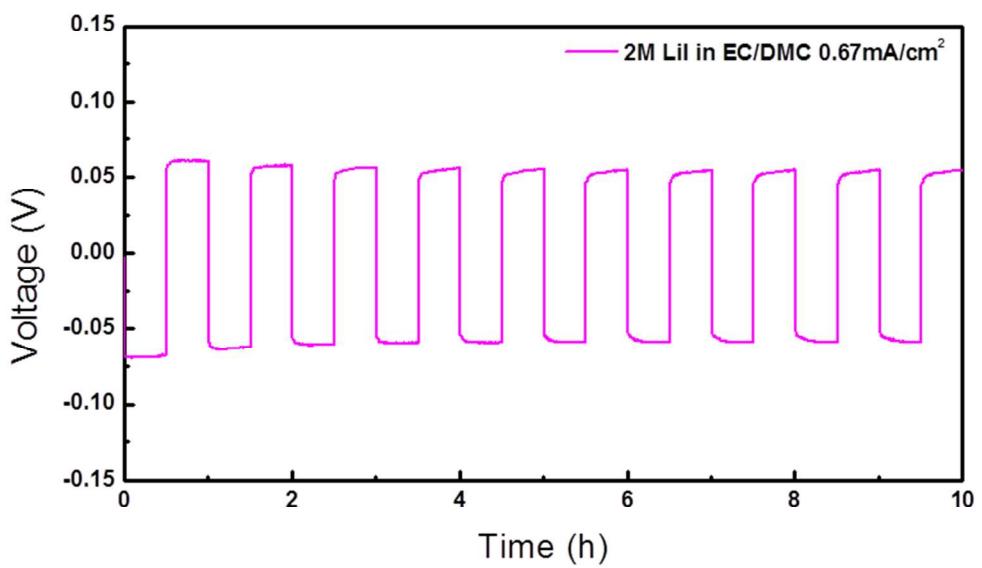
**Figure S3.** a) The voltage profiles of Li||Li cell cycled in 2M LiI-DMC electrolyte; The SEM images of cycled Li. b), c) are the top view and d), e) are the cross section view of Li from the LiI-DMC electrolyte cell. (After 20 cycles at  $1 \text{ mA cm}^{-2}$  for  $0.5 \text{ mAh cm}^{-2}$ .)



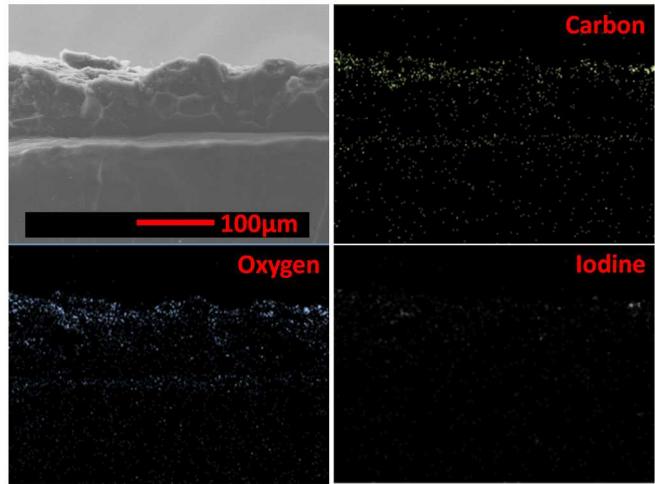
**Figure S4.** a) The voltage profiles of Li||Li cell cycled in 2M LiI-EC electrolyte at  $1 \text{ mA}/\text{cm}^2$ ; b) Optical images of the beaker and Li from the LiI-EC electrolyte cell after 20 cycles at  $1 \text{ mA cm}^{-2}$  for  $0.5 \text{ mAh cm}^{-2}$ .



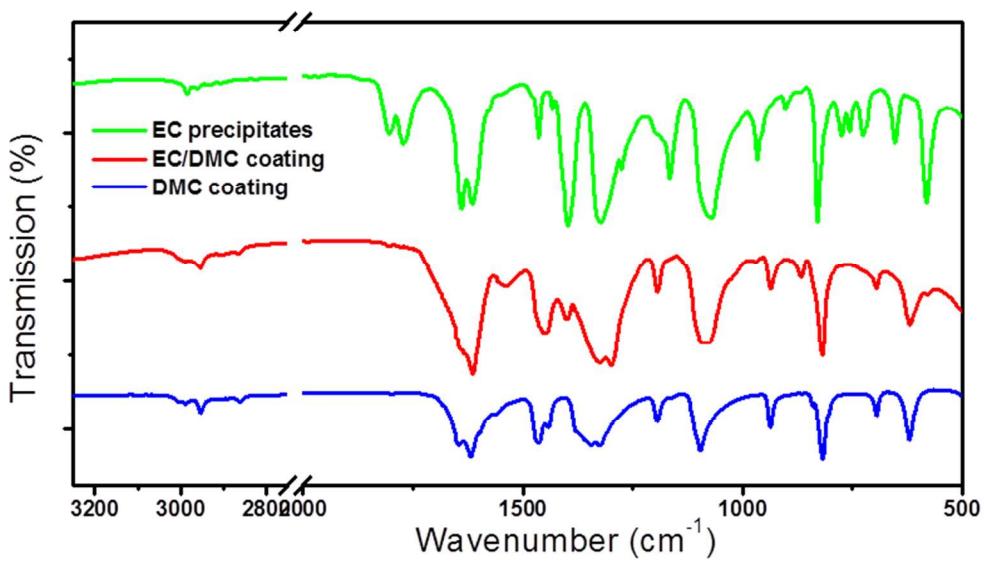
**Figure S5.** a) The voltage profiles of Li||Li cell cycled in 2M LiI-DME (1, 2-dimethoxy ethane) electrolyte at  $1 \text{ mA cm}^{-2}$ ; b) Optical images of the beaker and Li from the LiI-DME electrolyte cell after 20 cycles at  $1 \text{ mA cm}^{-2}$  for  $0.5 \text{ mAh cm}^{-2}$ .



**Figure S6.** The voltage profiles of Li||Li cell cycled in 2M LiI-EC/DMC electrolyte at  $0.67 \text{ mA cm}^{-2}$ .



**Figure S7.** The cross section view of Li from the LiI-EC/DMC electrolyte cell after 100 cycles at  $1 \text{ mA cm}^{-2}$  for  $1.5 \text{ mAh cm}^{-2}$ ; and EDS elemental mapping of C, O, and I, respectively.



**Figure S8.** ATIR spectra of precipitates and coating from LiI-EC, LiI-EC/DMC and LiI-DMC electrolytes.

1. Xu, K.; Zhuang, G. R. V.; Allen, J. L.; Lee, U.; Zhang, S. S.; Ross, P. N.; Jow, T. R., Syntheses and Characterization of Lithium Alkyl Mono- and Dicarbonates as Components of Surface Films in Li-Ion Batteries. *J Phys Chem B* **2006**, *110* (15), 7708-7719.
2. Bridel, J. S.; Grugeon, S.; Laruelle, S.; Hassoun, J.; Reale, P.; Scrosati, B.; Tarascon, J. M., Decomposition of Ethylene Carbonate on Electrodeposited Metal Thin Film Anode. *J Power Sources* **2010**, *195* (7), 2036-2043.
3. Gireaud, L.; Grugeon, S.; Laruelle, S.; Pilard, S.; Tarascon, J. M., Identification of Li Battery Electrolyte Degradation Products Through Direct Synthesis and Characterization of Alkyl Carbonate Salts. *J Electrochem Soc* **2005**, *152* (5), A850-A857.