

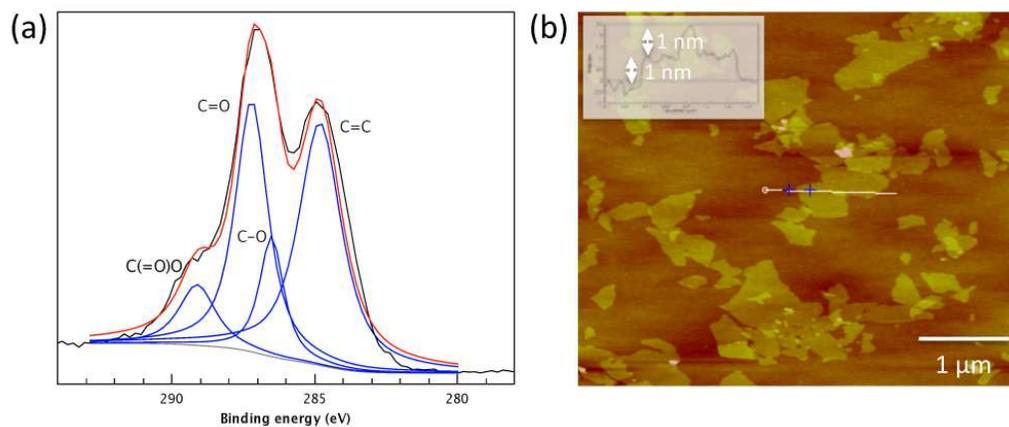
# Supporting Information

## Li-Anode Protective Layers for Li Rechargeable Batteries via Layer-by-Layer Approaches

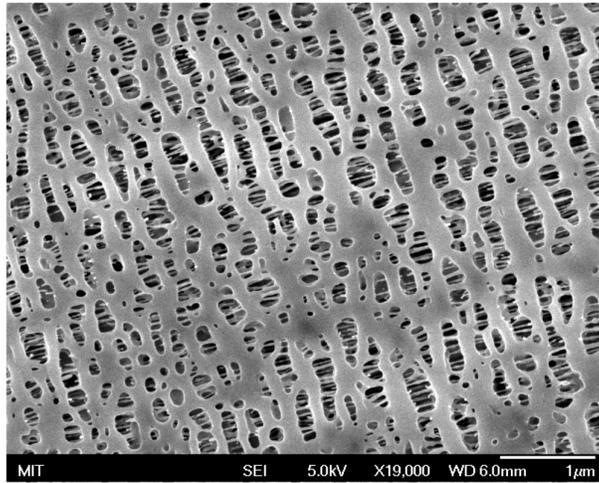
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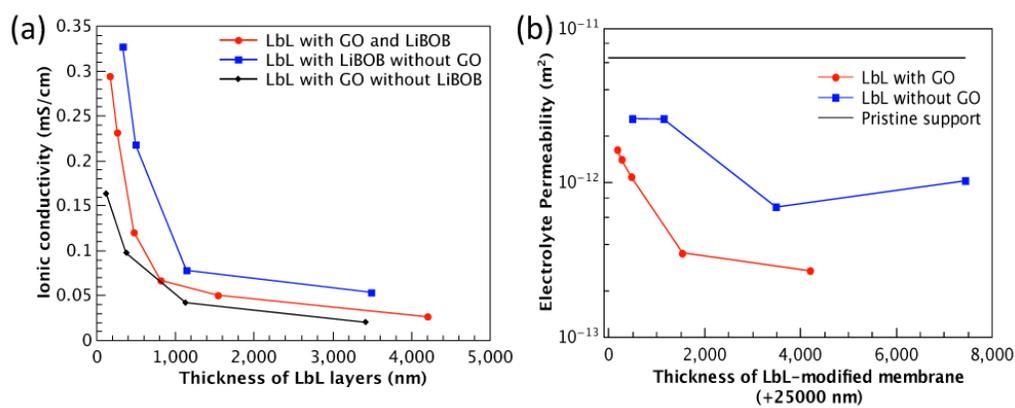
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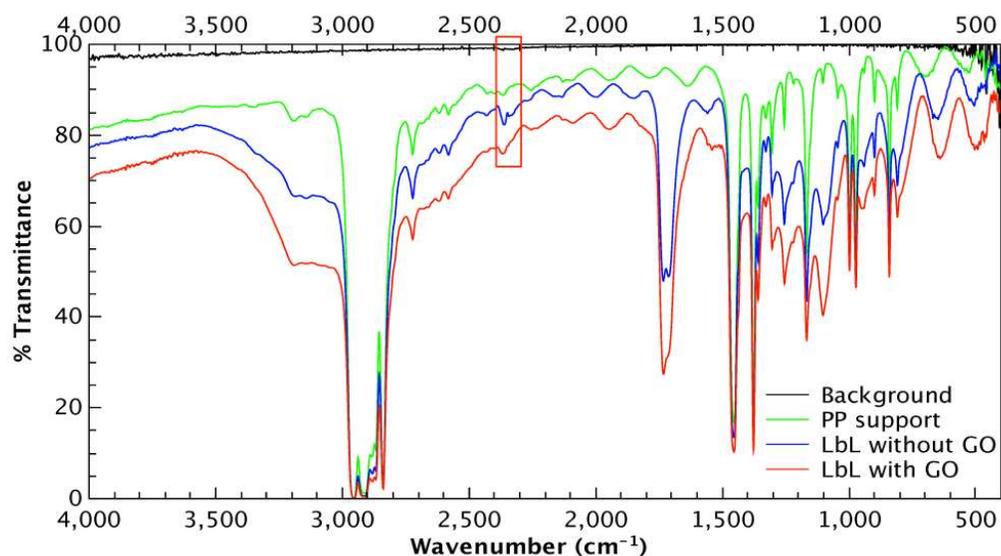
**Figure S1.** (a) C1s X-ray photoelectron spectroscopy (XPS) scan and (b) atomic force microscopy (AFM) image of graphene oxide.



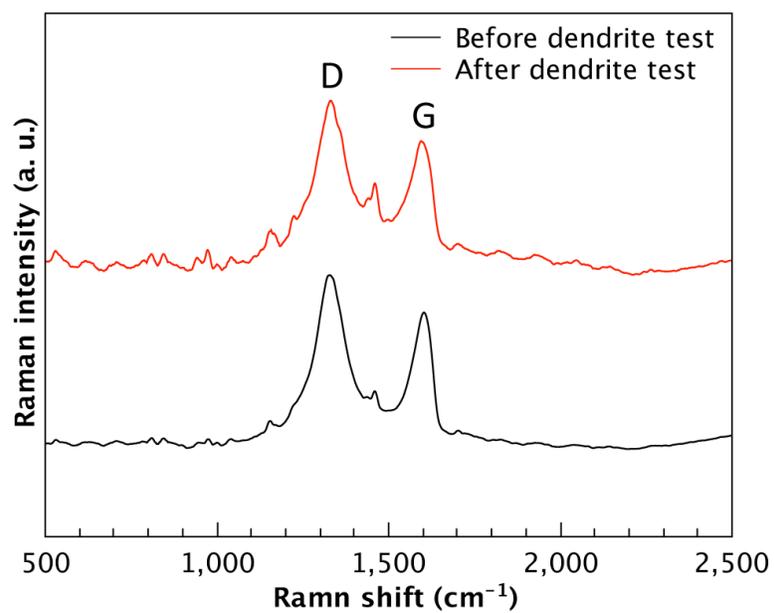
**Figure S2.** (a) SEM top-view images of polypropylene (PP) membrane after O<sub>2</sub> plasma treatment for 30 s.



**Figure S3.** A comparison (a) ionic conductivities of LbL-modified membranes following three cases: LbL with GO and without LiBOB in polymer solution (black), LbL with GO and LiBOB in polymer solution (red) and LbL without GO and with LiBOB in polymer solution (blue). (b) Electrolyte permeabilities of whole film (PP membrane + LbL layers) with and without GO incorporation.



**Figure S4.** FT-IR spectra of background, PP support membrane and LbL films with and without GO on support membrane. We purged the measurement chamber with  $N_2$  for 30 min to remove environmental  $H_2O$  peak before measurement.  $H_2O$  peak is shown between  $2300\text{ cm}^{-1}$  and  $2400\text{ cm}^{-1}$ . As shown in this figure, we couldn't observe  $H_2O$  peak in background under  $N_2$  purge. However, A peak at  $2360\text{ cm}^{-1}$  was observed for LbL with and without GO, whereas water peak was hardly detected in PP support membrane. These results indicate that the LbL films retain some water molecules within the film.



**Figure S5.** Raman spectra before and after dendrite formation test. 12-tetralayered LbL films were used for the test. There is no significant change of D and G peaks before and after test. It means GO was not severely reacted under applied constant current.