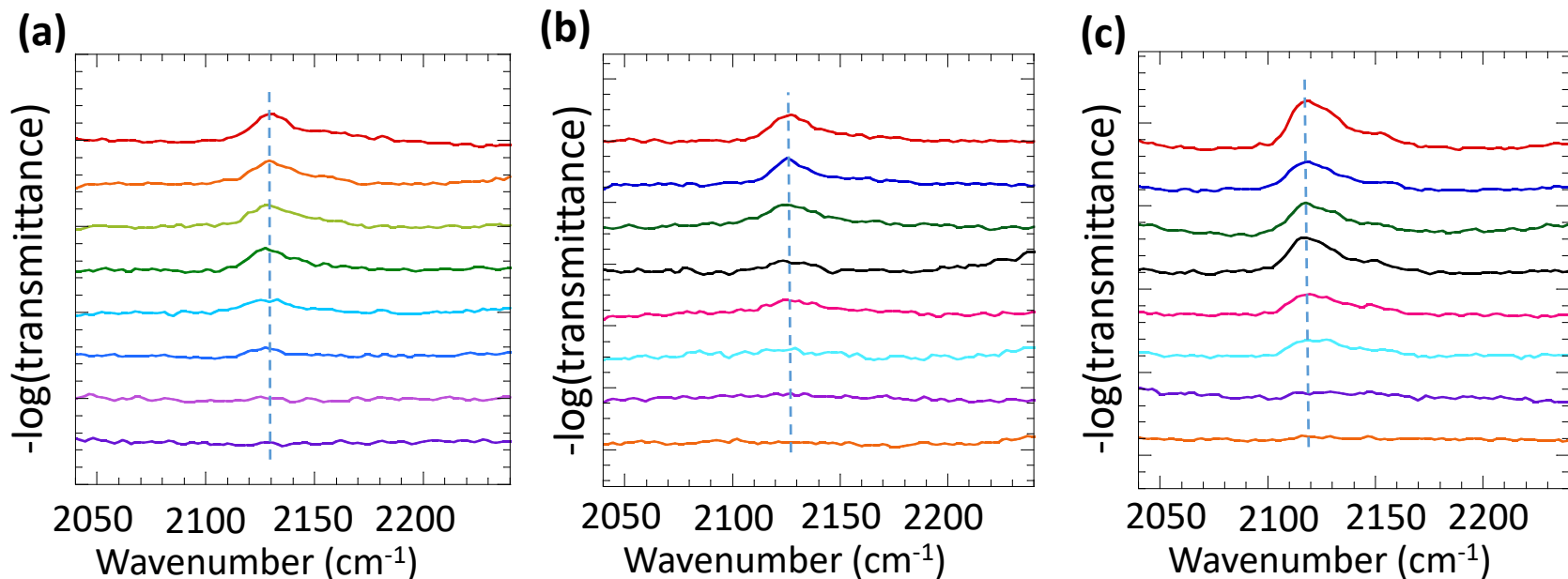
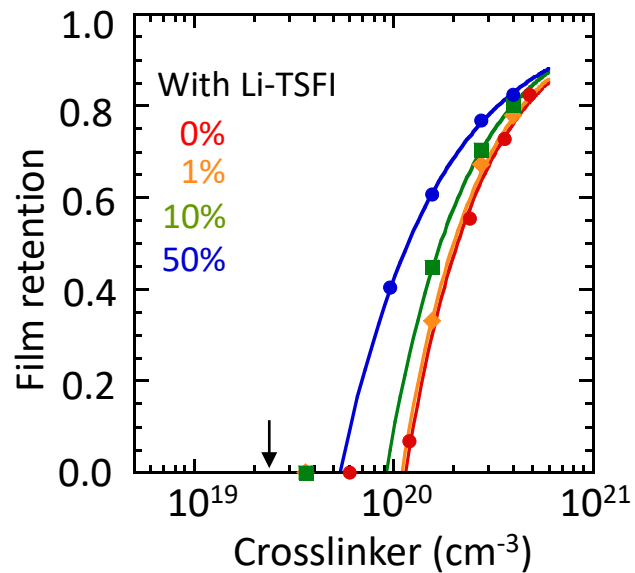


Supplementary Figure 1 FTIR spectra at the azide vibrational region of photo-crosslinker as a function of time. 10wt/wt% photo-crosslinker in 200-nm-thick PSSNa (M_w 75k) (a) of FPA70-TfO (b) FPA80-TfO (c) sFPA82-TfO. Film pre-heated at 100°C 5 min to remove moisture before UV 245 nm excitation for different intervals: 0s (red), 10s (orange), 30s (light green), 60s (dark green), 90s (light blue) and 120s (dark blue) and 150s (light purple) and 210s (dark purple). Asymmetric stretching frequencies of azide $\nu_{as}(N_3)$ at 2121 cm⁻¹ is marked in the plot (blue dotted line).



Supplementary Figure 2 FTIR spectra at the azide vibrational region of photo-crosslinkers at different bake-temperature. 10 wt/wt% photo-crosslinker in 200-nm thick PSSH ($M=75k$) **(a)** of FPA70-TfO **(b)** FPA80-TfO **(c)** sFPA82-TfO. Film is heated at different temperature for 5 min. no anneal (red), 100°C (orange), 110°C (light green), 120°C (dark green), 130°C (light blue), 140°C (dark blue), 150°C (light purple), 180°C (dark purple). Asymmetric stretching frequency of azide $\nu_{as}(N_3)$ at about 2120 cm^{-1} is marked in the plot.



Supplementary Figure S3. Plot of film retention against crosslinker concentration for different mol% bis(trifluoromethane)sulfonamide lithium (Li-TSFI) to mTFF-C₂F₅SIS-Na polymer. sFPA82-TfO in mTFF-C₂F₅SIS-Na films. Black arrow marks the theoretical gel point of M_w 40 k mTFF-C₂F₅SIS-Na, which is $2.3 \times 10^{19} \text{ cm}^{-3}$, corresponding to 1.9 wt/wt% of crosslinker to polymer in the film. Starting film thickness is *ca.* 100-nm thick.