**Figure captions**

Fig. 1: Possible schematic structure of synthesized polymer composite membrane.

Fig. 2: XRD spectra of the PCL and different PCL+IL composite system

Figure 3: SEM image of (a) & (b) PCL membrane, (c) & (d) 80PCL-20IL electrolyte at two magnifications

Fig. 4: FTIR spectra of different constituent in polymer composite membrane.

Fig. 5: Raman Study of different constituent of polymer composite membrane.

Fig. 6: Variation of conductivity with different IL composition in polymer composite.

Fig. 7(a): Variation of ln σ with Temperature and (b): variation of conductivity with frequency and temperature in polymer composite membrane.

Fig. 8: Change in dielectric constant (ε') and loss (ε") with frequency of 80PCL-20IL electrolytes at different temperatures.