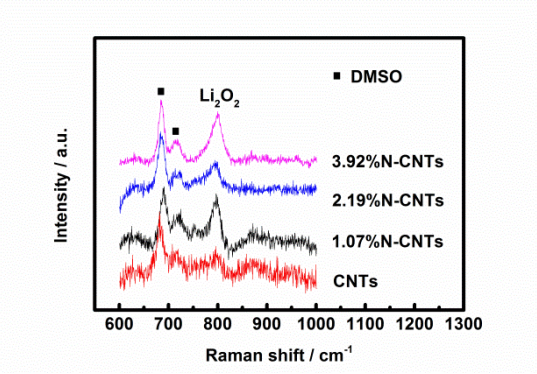

Fig. S1 Raman spectra of four electrodes with different nitrogen amount after the first discharge process.

In order to further identify the composition of the amorphous products on CNTs and N-CNTs electrodes with different nitrogen amount, Raman spectra of the discharge products in the sulfones-based electrolyte were plotted in Fig. S1. One symmetric peak was observed around 795 cm^{-1}, which is attributed to the existence of Li_2O_2, meanwhile the typical peaks of DMSO at 685 and 717 cm^{-1} are also detected. These observations indicate that the discharge products are mainly composed of Li_2O_2 in sulfones-based electrolyte.

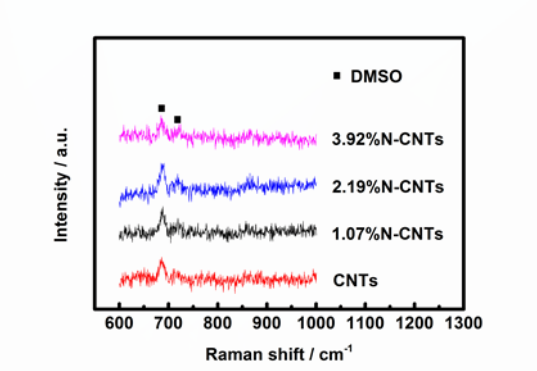

Fig. S2 Raman spectra of four electrodes with different nitrogen amount after the first charge process.

Meanwhile, after the charge process, no obvious peak around 795 cm^{-1} was detected in all samples, which indicated that most of Li_2O_2 has been decomposed after the charge process, as shown in Fig. S2.