Graphene Oxide-Polyvinylidene Fluoride Composite Membrane for Lithium Metal Battery Applications

Department of Chemical and Materials Engineering, Chang Gung University, Taiwan[1], Center for Sustainability and Energy Technologies, Chang Gung University, Taiwan[2]

◦Chia-Ching Kuo[1], Meng-Wen Chiu[1], Wei-Fan Kuan[1,2,*]

E-mail: weifankuan@mail.cgu.edu.tw

Lithium metal is considered as an ideal anode candidate for high-energy-density batteries due to its high theoretical capacity (3860 mAh g-1), which significantly surpasses that of commercial graphite anodes (372 mAh g-1). However, the formation of lithium dendrites during cycling poses a significant challenge, leading to electrolyte decomposition, interfacial instability, and safety concerns in lithium metal batteries. To alleviate the impacts from the lithium dendrite growth, in this study we designed a poly(vinylidene fluoride)-graphene oxide (PVDF-GO) composite membrane as the separator in lithium metal batteries. Our results demonstrated that the β-phase crystalline of PVDF in the composite membrane was promoted from 40% to 66% by adding an optimal loading of GO. Additionally, the synthesized PVDF-GO membrane exhibited an ionic conductivity of 1.33 mS cm-1 and remarkable transference number of 0.72. The high compatibility between lithium metal and PVDF-GO was also verified by the long-term cycling tests in Li|PVDF-GO|Li symmetric cell. Moreover, the Li|PVDF-GO|LFP full cells demonstrated a high discharge capacity of 150 mAh g-1 at 0.2 C and 112 mAh g-1 even at 5.0 C. These results present a great potential for the PVDF-GO composite membrane in the applications of lithium metal batteries with higher stability.

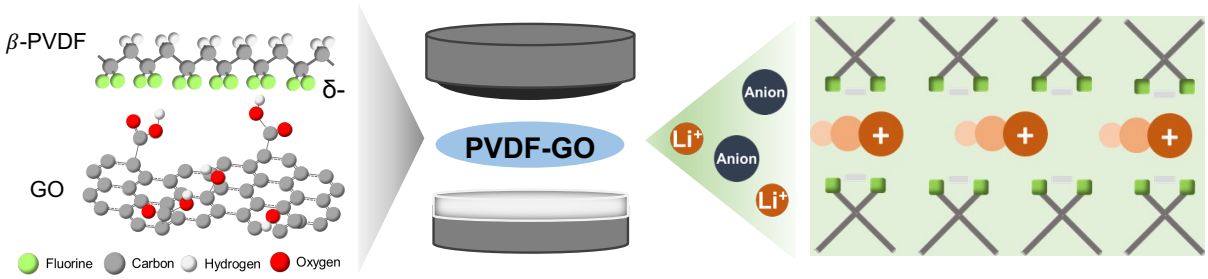

Fig. 1. Schematic of PVDF-GO composite membrane with improved transport properties.