

**Project Title: Fabrication and Characterization of Polymer Rechargeable Lithium Ion Battery****\*Project Leader & Members: Dr. A. H. You\*, Dr. L. L. Teo, Mr. H. Hanapei, Ms. Y. L. Yap, Ms. P. L. Cheang****Abstract**

The PEO-EC-LiCF<sub>3</sub>SO<sub>3</sub>-Al<sub>2</sub>O<sub>3</sub> battery with the high ionic conductivity of  $2.970 \times 10^{-5}$  S/cm produces the stable output voltage compare to other battery. The simulated current density using Monte Carlo method is 44.6 mA/cm<sup>2</sup> in our model. This is PEO polymer battery is rechargeable, weigh less, non-toxic and environmental friendly. The PEO polymer electrolytes can be used to fabricate the polymer lithium ion battery which is marketable for smart-phone, netbook, digital camera and iPad usages.

**Objectives:**

1. To fabricate and characterize the polymer rechargeable lithium ion battery
2. To identify the high ionic conductivity polymer electrolytes

**Research Methodology:**

In this study, the polymer electrolyte materials are prepared using the solution cast method. Polymers, plasticizers and lithium salts are added accordingly with appropriate solvent.

The polymer electrolyte samples for lithium battery can be conceived as a system composed of four components: a polymer, for example, polyethylene oxide (PEO); a lithium salt, like LiClO<sub>4</sub>, LiPF<sub>6</sub>, LiBF<sub>4</sub> or others; a filler, TiO<sub>2</sub>, SiO<sub>2</sub>, Al<sub>2</sub>O<sub>3</sub> or others; and a plasticizer, such as propylene carbonate (PC), dimethyl carbonate (DMC), ethylene carbonate (EC) etc.

The polymer rechargeable lithium ion battery will be fabricated and tested in this work as a final product.

**Outputs:***Journal/Conference Papers:*

1. Inorganic Filler Sizes Effect on Ionic Conductivity in Polyethylene Oxide Composite Polymer Electrolyte by Y. L. Yap, A. H. You, L. L. Teo and H. Hanapei, International Journal of Electrochemical Science, Vol. 8, pp. 2154-2163, 2013.
2. Monte Carlo Simulation of Ionic Conductivity in Solid Polymer Electrolytes by P. L. Cheang, L. L. Teo, E. K. Wong, A. H. You, 4<sup>th</sup> International Conference on Solid State Science and Technology 2012, Melaka, 18<sup>th</sup> – 20<sup>th</sup> December 2012.

*PhD and MEngSc Theses:*

1. Fabrication and Characterization of PEO Lithium Ion Battery
2. Modeling of Solid Polymer Electrolyte for Lithium Ion Battery

Approved Budget: RM250,000.00

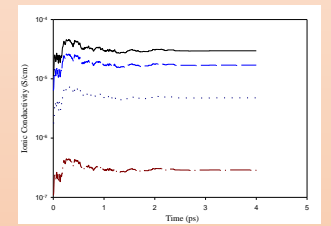
Project Duration: 01 October 2011 until 30 September 2013 (2 years)



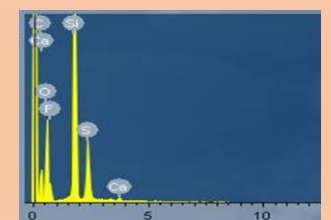
Po-Li Battery

SEM micrographs of PE-based electrolyte film with Al<sub>2</sub>O<sub>3</sub> < 50 nm

EIS Spectroscopy

Ionic conductivity of PEO-EC-LiCF<sub>3</sub>SO<sub>3</sub> composite polymer electrolyte from MC model

FTIR Spectroscopy

EDX elemental analysis of PEO electrolyte film with SiO<sub>2</sub> (< 10 μm)