Abstract

Poly(ethylene oxide) (PEO) has been doped with selected organotin compounds. The organotin dopants used were triphenyltin thiocyanate (Ph_3SnSCN) and tetramethylammonium dichlorotriphenylstannate $[Ph_3SnCl]^-[Me_4N]^+$. Tin incorporation in the polymers was established by several physical techniques. The infrared spectroscopic analysis of the Ph_3SnSCN – doped electrolyte film showed bands at 2080-2050 $cm,^{-1}$ which are also given by pure Ph_3SnSCN. Different concentrations of organotin doped electrolytes were prepared and conductivity studies on these were performed using impedance spectroscopy. From the measurements it was found that the best conductivity of 7.6×10^{-8} S/cm was obtained for the composition with PEO :dopant ratio of 90:10 at room temperature. However, it proved possible to increase the conductivity by at least two to three orders of magnitude by the co-addition of plasticizers such as ethylene carbonate (EC) and propylene carbonate (PC), thereby rendering the modified PEO more suitable as an electrolyte material for the solid state batteries. The best conductivity thus attained was of the order of 10^{-5} S/cm for the film of composition Ph_3SnSCN doped PEO : plastizier of 90 :10. The plasticizer component consists of EC and PC in 1:1 ratio.X- ray diffraction analysis confirmed the disruption of the crystalline order of PEO upon interaction with the tin dopants. A similar pattern of results was obtained with tetramethylammonium dichlorotriphenyl stannate as dopant. However, the conductivity was only of the order of 10^{-8} Scm^{-1} and not as good as that given by the Ph_3SnSCN compound. The best conducting sample of triphenyltin thiocyanate-polymer was used in the fabrication of a

primary cell using Sn metal as the anode and a carbon-iodine mixture as the cathode material. The fabricated cell showed an open circuit voltage (OCV) of 0.40V.

Abstrak

PEO telah didopkan dengan sebatian "Organotin" yang terpilih. Pendopan "Organotin" yang digunakan adalah Ph_3SnSCN dan $[Ph_3SnCl]^-$ $[Me_4N]^+$. Penerapan stannun ke dalam polimer telah sahkan melalui beberapa teknik fizikal. Analisis spektroskopi inframerah bagi filem elektrolit yang didopkan Ph_3SnSCN menunjukkan ikatan pada 2080-2050 cm^{-1}, yang mana ianya juga ditunjukkan oleh kompaun Ph_3SnSCN tulen. Pendopan elektrolit dengan kepekatan organotin yang berlainan disediakan dan kajian kekonduksian ke atasnya dilakukan dengan kaedah impedans spektroskopi. Daripada pengukuran didapati kekonduksian yang terbaik telah dicapai iaitu 7.6×10^{-8} S/cm dengan hisbah PEO. Garam bresamaan 90:10. Kekonduksian masih dapat ditingkatkan beberapa tertib magnitud dengan penambahan 'plasticizers' seperti etilena karbonat (EC) dan propilena karbonat (PC), dan kekonduksian terbaik yang dicapai ialah 10^{-5}S/cm untuk kompleks polimer-garam-plasticizer. Komponen 'plastisizer' terdiri daripada EC dan PC dalam nisbah 1:1. Analisis pembelauan sinar –X menunjukkan pemusnahan hablur PEO yang berinteraksi dengan pendop tin. Corak keputusan yang sama telah diperolehi dengan tetramethyl ammonium dichlorotriphenylstannate sebagai pendop. Walaubagaimanapun, nilai kekonduksian hanya $10^{-8}Scm^{-1}$ dan ianya tidak sebaik yang diperolehi dengan sebatian Ph_3SnSCN. Sampel pengkonduksi yang baik dari tripheyltin thiocyannate –polimer telah digunakan dalam pemfabrikatan sel pertama dengan logam Sn sebagai anod dan karbon-iodin sebagai katod. Sel ini telah memberikan nilai voltan litar terbuka (OCV) sebanyak 0.40 V.