An investigation on LiCF3SO3 dopep plasticizer as potential solid electrolyte for lithium batteries / Syed Mohd Farid Syed Faissal.

Lihat sebelah

AN INVESTIGATION ON $LiCF_3SO_3$ DOPED PLASTICIZER AS POTENTIAL SOLID ELECTROLYTE FOR LITHIUM BATTERIES

By
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the requirements of the award of the degree of
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DEPARTMENT OF PHYSICAL SCIENCES
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PENGAKUAN DAN PENGESAHAN LAPORAN PITA I DAN II

Adalah ini diakui dan disahkan bahawa laporan penyelidikan bertajuk: An Investigation on $LiCF_3SO_3$ Doped Plasticizer As potential Solid Electrolyte for Lithium Batteries.

oleh Syed Mohd Faid B. Syed Faissal, no. matrik: UK11888 telah diperiksa dan semua pembetulan yang disarankan telah dilakukan. Laporan ini dikemukakan kepada Jabatan Sains Fizik sebagai memenuhi sebahagian daripada keperluan memperolehi Ijazah Sm. Sn. Gunaan Fizik Elektronik & Instrumentan Fakulti Sains dan Teknologi, UMT.

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DECLARATION

I hereby declare that this thesis entitled An Investigation on $LiCF_3SO_3$ Doped Plasticizer As Potential Solid Electrolyte for Lithium Batteries

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ABSTRACT

Using the solution cast technique, solid polymer electrolytes composed of chitosan and PEO as the host polymer and lithium triflate ($LiCF_3SO_3$) as the doping salt were prepared. Propylene carbonate (PC) and ethylene carbonate (EC) as a plasticizer was added to the solutions, respectively. The conductivity and dielectric behavior of plasticized chitosan/PEO-30 wt.% $LiCF_3SO_3$ were studied from 42 Hz to I MHz at room temperature by EIS. For EC complexes, the highest conductivity was obtained at 50 wt.% (2.93×10^{-5} S/cm) and 15 wt.% (8.89×10^{-6} S/cm) for PC. The ionic conductivity of the EC polymer complexes are about 1 magnitude higher than that of chitosan/PEO-30 wt.% $LiCF_3SO_3$ but in PC polymer complexes, the conductivity did not improve much. The dielectric data for both EC and PC polymer complexes were analyzed using complex impedance Z^*, complex permittivity ε^*, complex electric modulus M^* and loss tangent, tan δ. The complexation effects of salt and plasticizers in polymer blend host electrolytes had been investigated using FTIR. The carbonyl stretch of chitosan locates at 1648 cm^{-1}. With the addition of PC, the band disappear in favor to monodentate ion pair. The υ_s (SO_3) of $LiCF_3SO_3$ in the complexes appeared at 1031 cm^{-1} for both EC and PC comes from free trimethanesulfonate anions. EC-PEO interactions are indicated by the shifting of N-H angular deformation band of PEO from 1340 cm^{-1} being shifted to 1353-1398 cm^{-1} in the complex. In PC, this band is shifted to 1054 cm^{-1} and become weak.

ABSTRAK

Dengan menggunakan teknik 'solution casting', polimer elektrolit jenis pepejal yang mengandungi chitosan dan PEO sebagai polimer asas dan lithium triflate ($LiCF_3SO_3$) sebagai garam pengdopan telah disediakan. Propylene carbonate (PC) dan ethylene carbonate (EC) telah ditambah ke dalam larutan sebagai bahan pemplastik. Konduktiviti dan sifat dielektrik chitosan/PEO-30 wt.% $LiCF_3SO_3$ yang telah ditambah bahan pemplastik di kaji dari 42 Hz hingga 1 MHz pada suhu bilik dengan menggunakan EIS. Untuk kompleks EC, konduktiviti yang paling tinggi telah diperolehi ialah pada 50 wt.% (2.93×10^{-5}) dan 15 wt.% (8.89×10^{-6}) bagi PC. Konduktiviti ionik bagi polimer kompleks EC adalah lebih kurang 1 magnitud lebih tinggi daripada chitosan/PEO- 30 wt.% $LiCF_3SO_3$. Tetapi pada polimer kompleks PC, nilai konduktiviti tidak banyak meningkat. Data dielektrik bagi kedua-dua polimer kompleks EC dan PC telah dianalisis menggunakan 'complex impedance Z^*', 'complex permittivity ε^*', 'complex electric modulus M^*' dan 'loss tangent tan δ'. Kesan struktur kompleks garam dan bahan plastik di dalam elektrolit campuran polimer asas telah di siasat dengan menggunakan FTIR. Tegangan karbonil dalam chitosan terletak pada 1648 cm^{-1}. Dengan penambahan PC, tegangan ini hilang kerana membentuk pasangan ion 'monodentate'. υ_s (SO_3) dalam kompleks $LiCF_3SO_3$ yang muncul pada 1031 cm^{-1} untuk kedua-dua EC dan PC adalah dari ion bebas trimethanesulfonate. Interaksi di dalam kompleks antara EC-PEO dikenal pasti daripada anjakan kumpulan pembentukan N-H bersudut pada PEO dari 1340 cm^{-1} teranjak ke 1353-1398 cm^{-1}. Di dalam PC, kumpulan ini teranjak ke 1054 cm^{-1}dan menjadi lemah.