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Preparation and characterization of materials for lithium polym batteries / Rahimah Othman.

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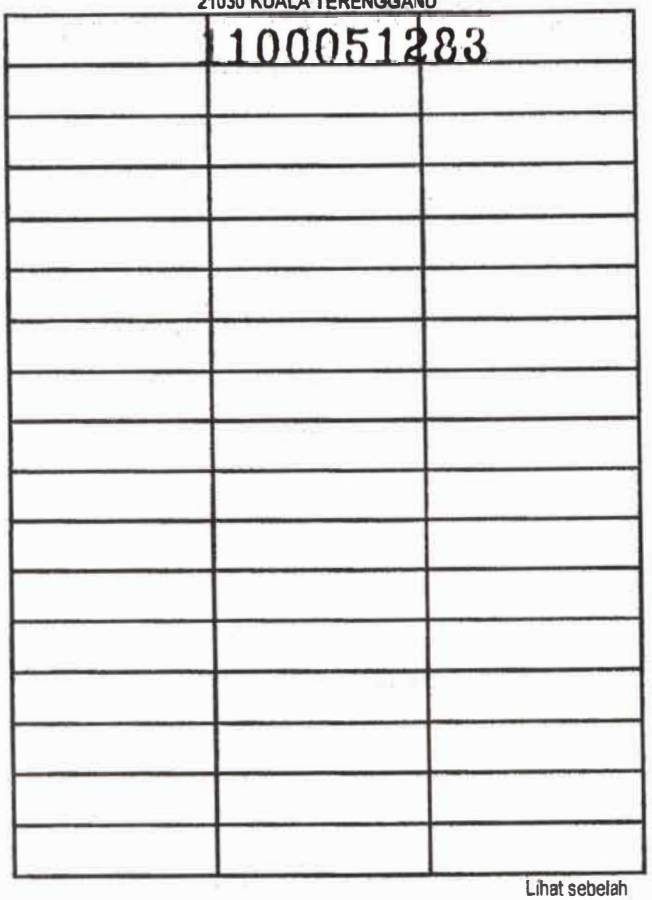

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Perpustakaan Sultanah Nur Zahirah (UMT)
Universiti Malaysia Terengganu

PREPARATION AND CHARACTERIZATION OF MATERIALS FOR LITHIUM POLYMER BATTERIES

By

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Research Report submitted in partial fulfillment of
the requirement for degree of
Bachelor of Applied Sciences (Physics Electronics and Instrumentations)

Department of Physical Sciences
Faculty of Sciences and Technology
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PENGAKUAN DAN PENGESAHAN LAPORAN PROJEK PENYELIDIKAN I DAN II

Adalah ini diakui dan disahkan bahawa laporan penyelidikan bertajuk:

PREPARATION AND CHARACTERIZATION OF MATERIALS FOR LITHIUM POLYMER BATTERIES oleh **RAHIMAH BINTI OTHMAN**, no matrik **UK9958** telah diperiksa dan semua pembetulan yang disarankan telah dilakukan. Laporan ini dikemukakan kepada Jabatan Sains Fizik sebagai memenuhi sebahagian daripada keperluan Ijazah Sarjana Muda Sains Gunaan (Fizik Elektronik dan Instrumentasi), Fakulti Sains dan Teknologi, Universiti Malaysia Terengganu.

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TABLE OF CONTENTS

Perpustakaan Sultanah Nur Zahirah (UMT)
Universiti Malaysia Terengganu

CHAPTER 3: METHODOLOGY

CHAPTER 4: RESULTS AND DISCUSSION

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS/SYMBOLS

A	the area of film-electrode contact
CF_3SO_3-	trifluoromethanesulfonate
DMP	dimethyl phthalate
E_a	activation energy
EIS	Electrochemical Impedance Spectroscopy
FTIR	Fourier Transform Infrared Spectroscopy
Hz	hertz
IR	infrared
k	Boltzmann constant (1.38 x 10-23 J@K)
K	kelvin
Li	lithium
$LiBF_4$	lithium tetrafluoroborate
$LiCF_3SO_3$	Lithium Trifluoremethane Sulfuric Acid
$LiClO_4$	lithium perchlorate
Li-ion	lithium ion
Li-Poly	lithium polymer battery
LiPo	lithium polymer battery
LiTf	lithium triflate
LPB	lithium polymer battery
MHz	mega hertz
M_r	real electrical modulus
M_i	imaginary electrical modulus
mm	millimeter
PAN	polyacrylonitrile
PC	personal computer
PEO	polyethylene oxide

PMMA	polymethyl methacrylate
PVA	Polyvinyl alcohol
PVC	poly(vinyl chloride)
PVdF	polyvinylidene fluoride
PVP	poly(vinylprrolidone)
R_b	bulk resistance of the film
R^2	regression value
SPE	solid polymer electrolytes
S/cm	siemen per centimeter
t	thickness of the film
tan δ	loss tangent
T	absolute temperature
T_m	melting point (for thermoplastics) temperature
T_g	glass transition temperature
TS	tensile strength
wt.%	weight percent
Z^*	complex impedance
Z_r	real impedance
Z_i	imaginary impedance
δ_s	symmetric stretching mode
ε_r,	dielectric constant
ε_i,	dielectric loss
σ_0	pre-exponential factor
υ_s	symmetric stretching vibration
υ_{as}	asymmetric stretching vibration
C_0	pre-exponential factor
ω	angular frequency ($2\pi f$)

ABSTRACT

Solid polymer electrolyte films containing chitosan-poly(vinyl alcohol) (PVA)-$LiCF_3SO_3$ were prepared by solution casting technique. Chitosan/PVA (50:50 w/w) solution was diluted in 100 ml 1% acetic acid solution and stirred using magnetic stirrer overnight at room temperature. Various amount of lithium triflate were added accordingly varies from 5 to 50 wt.%. Complexation of the prepared electrolytes is studied by using EIS and FTIR analysis. The structure of chitosan, PVA and lithium triflate and the miscibility of the blend films were investigated and proved from infrared spectroscopy. Ionic conductivities of the electrolyte have been determined by AC impedance studies in the temperature range of 300-393 K. Results show that the regressions values are obey the Arrhenius plot. Dielectric relaxation studies of the polymer electrolyte have been undertaken and the results were discussed. The highest ionic conductivity value (2.71027×10^{-5} S/cm) has been observed for chitosan (0.275g)-PVA (0.275g)-$LiCF_3SO_3$ (45 wt.%) system with the activation energy, E_a observed is 0.25 eV.

ABSTRAK

Polimer elektrolit filem jenis pepejal yang mengandungi chitosan-poly(vinyl alcohol) (PVA)-$LiCF_3SO_3$ disediakan dengan menggunakan teknik 'solution casting'. Larutan Chitosan/PVA (50:50 w/w) dilarutkan di dalam 100 ml 1% larutan asid asetik dan dikacau dengan menggunakan 'magnetic stirrer' semalaman pada suhu bilik. Lithium triflate ditambah secara selaras mengikut kuantiti berat yang berbeza daripada 5 ke 50 %. Struktur kompleks elektrolit dianalisis dengan menggunakan EIS dan FTIR. Struktur bagi chitosan, PVA dan lithium triflate serta misibiliti bagi campuran polymer dikenalpasti dan dibuktikan dengan menggunakan sinar inframerah spectrometer. Konduktiviti ion elektrolit dikenalpasti melalui ujikaji 'AC Impedance' pada suhu antara 300-393 K. Hasil menunjukkan nilai-nilai regrasi mematuhi plot Arrhenius. Kajian dielektrik bagi elektrolit jenis polimer diperhatikan dan keputusannya dibincangkan dengan lebih lanjut. Nilai konduktiviti ion yang paling tinggi (2.71027×10^{-5} S/cm) dikenalpasti pada sistem chitosan (0.275g)-PVA (0.275g)- $LiCF_3SO_3$ (45 wt.%) dengan nilai tenaga pengaktifan, E_a yang diperoleh adalah 0.25 eV.