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Fourier transform infrared (FTIR) spectroscopy gel electrolyte studies of chitosan polymer / Nurul A'ien Morsid.

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FOURIER TRANSFORM INFRARED SPECTROSCOPY (FTIR)
STUDIES OF CHITOSAN POLYMER
GEL ELECTROLYTES

By

Nurrul A'iiin binti Morsid

Research Report submitted in partial fulfillment of
the requirement for the degree of
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**PENGAKUAN DAN PENGESAHAN LAPORAN
PROJEK PENYELIDIKAN I DAN II**

Adalah ini diakui dan disahkan bahawa laporan penyelidikan bertajuk:

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LIST OF ABBREVIATIONS

ATR	Attenuated Total Reflection
CA	Chitosan acetate
C_{ϕ}	Carbon of the aromatic ring
DBP	Dibutyl phthalate
DMF	Dimethyl formamide
EC	Ethylene carbonate
EIS	Electrochemical Impedance Spectroscopy
FTIR	Fourier Transform Infrared Spectroscopy
GPEs	Gel polymer electrolytes
PAN	Polyacrylonitrile
R_b	Bulk resistance
PC	Propylene carbonate
PCS	Photon Correlation Spectroscopy
PEO	Polyethylene oxide
PMMA	Poly(methyl methacrylate)
SA	Salicylic acid
SEM	Scanning Electron Microscopy
UV	Ultra violet
ν_s	Symmetric stretching vibration
ν_{as}	Asymmetric stretching vibration
ZnSe	Zinc Selenium
Z'	Real impedance
Z''	Imaginary impedance
σ	Conductivity
δ	Bending mode
ω	Wagging mode
ρ	Rocking mode
τ	Twisting mode

ABSTRACT

The first part of the paper is devoted to the study of the asymptotic behavior of the solutions of the Cauchy problem for the heat equation in the case of a variable coefficient. It is shown that the asymptotic behavior of the solutions is determined by the behavior of the coefficient at infinity. The second part of the paper is devoted to the study of the asymptotic behavior of the solutions of the Cauchy problem for the heat equation in the case of a variable coefficient. It is shown that the asymptotic behavior of the solutions is determined by the behavior of the coefficient at infinity. The third part of the paper is devoted to the study of the asymptotic behavior of the solutions of the Cauchy problem for the heat equation in the case of a variable coefficient. It is shown that the asymptotic behavior of the solutions is determined by the behavior of the coefficient at infinity. The fourth part of the paper is devoted to the study of the asymptotic behavior of the solutions of the Cauchy problem for the heat equation in the case of a variable coefficient. It is shown that the asymptotic behavior of the solutions is determined by the behavior of the coefficient at infinity. The fifth part of the paper is devoted to the study of the asymptotic behavior of the solutions of the Cauchy problem for the heat equation in the case of a variable coefficient. It is shown that the asymptotic behavior of the solutions is determined by the behavior of the coefficient at infinity. The sixth part of the paper is devoted to the study of the asymptotic behavior of the solutions of the Cauchy problem for the heat equation in the case of a variable coefficient. It is shown that the asymptotic behavior of the solutions is determined by the behavior of the coefficient at infinity. The seventh part of the paper is devoted to the study of the asymptotic behavior of the solutions of the Cauchy problem for the heat equation in the case of a variable coefficient. It is shown that the asymptotic behavior of the solutions is determined by the behavior of the coefficient at infinity. The eighth part of the paper is devoted to the study of the asymptotic behavior of the solutions of the Cauchy problem for the heat equation in the case of a variable coefficient. It is shown that the asymptotic behavior of the solutions is determined by the behavior of the coefficient at infinity. The ninth part of the paper is devoted to the study of the asymptotic behavior of the solutions of the Cauchy problem for the heat equation in the case of a variable coefficient. It is shown that the asymptotic behavior of the solutions is determined by the behavior of the coefficient at infinity. The tenth part of the paper is devoted to the study of the asymptotic behavior of the solutions of the Cauchy problem for the heat equation in the case of a variable coefficient. It is shown that the asymptotic behavior of the solutions is determined by the behavior of the coefficient at infinity.

ABSTRACT

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In this work, the synthesis of proton-conducting gel membranes obtained by incorporating in organic acid in poly(methyl methacrylate) (PMMA) matrix. Propylene carbonate (PC) and ethylene carbonate (EC) were used as solvents. Organic acid used in this work is salicylic acid (SA). The ionic conductivity of the electrolyte is $2.65 \times 10^{-5} \text{ S cm}^{-1}$ at room temperature. The gels were characterized by Fourier Transform Infrared (FTIR) Spectroscopy using Perkin-Elmer System 2000 FTIR Spectrometer with Attenuated Total Reflection (ATR) accessories. Observation on FTIR spectrum of the chitosan-salt gels is at 1389 cm^{-1} due to vibration mode of carboxyl group, $\nu(\text{COO}^-)$ which the salicylic acid proton donor has protonated. This proved that H^+ ions have dissociated as proton conductor. The obtained spectroscopic data has been correlated with the conductivity performance of chitosan-salt based polymer electrolytes.

ABSTRAK

ABSTRAK

Dalam kajian ini, gabungan gel membrane pengkonduksi-proton diperolehi dengan mencampurkan asid organik bersama matriks polimer “poly(methyl methacrylate)” (PMMA). Propilena karbonat (PC) dan etilena karbonat (EC) pula digunakan sebagai pelarut. Asid organik yang digunakan dalam kajian ini ialah asid salisilik (SA). Ion kekonduksian bagi elektrolit pada suhu bilik ialah $2.65 \times 10^{-5} \text{ S cm}^{-1}$. Sifat-sifat bagi suatu gel dikenalpasti dengan menggunakan “Fourier Transform Infrared (FTIR) Spectroscopy” jenis Perkin-Elmer 2000 FTIR Spektrometer bersama tambahan sistem iaitu “Attenuated Total reflection” (ATR). Hasil pemerhatian ke atas spektrum oleh FTIR bagi gel chitosan-SA, didapati pada 1389 cm^{-1} menunjukkan mod getaran bagi kumpulan karboksil (COO^-) di mana proton penderma asid salisilik (SA) terurai. Ini membuktikan bahawa ion H^+ telah mengurai sebagai konduktor proton. Data spektroskopik yang diperolehi adalah berhubung kait dengan nilai kekonduksian bagi polimer elektrolit chitosan-SA.