C 530 8

TRANSPORT PROPERTIES OF POLYMER ELECTROLYTES BASED ON POLY(ACRLONITRILE) AND POLY(ETHYLENE OXIDE) COMPLEXED WITH COPPER SALTS

A PROJECT REPORT PRESENTED BY

S.UDAKARA

to the Board of Study in Physics of the **POST GRADUATE INSTITUTE OF SCIENCE**

in partial fulfillment of the requirement for the award of degree of

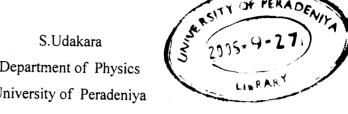
MASTER OF SCIENCE IN PHYSICS OF MATERIALS

of the

UNIVERSITY OF PERADENIYA SRI LANKA 2004

TRANSPORT PROPERTIES OF POLYMER ELECTROLYTES BASED ON POLY(ACRYLONITRILE) AND POLY(ETHYLENE OXIDE) COMPLEXED WITH COPPER SALTS

> S.Udakara Department of Physics University of Peradeniya



Transport properties of PAN: Cu(ClO₄)₂ polymer electrolyte and (PEO)₉CuCNS polymer electrolyte have been studied..

Three PAN based electrolytes were made with different composition of polyacrylonitrile (PAN), ethylene carbonate (EC), propylene carbonate (PC) and copper perchlorate Cu(ClO₄)₂. The highest conductivity was obtained for the 20 wt% PAN: 41 wt% EC: 34 wt% PC: 5 wt% Cu(ClO₄)₂ system over the entire temperature range. DC impedance measurements show that this PAN based polymer electrolytes are predominantly ionic conductors and the AC impedance shows that the electrolytes reach conductivities of the order of 10⁻² Scm⁻¹ around 80 °C. Even at room temperature, the conductivity remains quite high, of the order of 10⁻³ Scm⁻¹. The temperature variations of all PAN based systems follow VTF behaviour and DC polarization measurements show that the dominant charge carriers appear to be ClO₄

DC .measurements show that the composite polymer electrolyte (PEO)₉CuCNS+10wt%Al₂O₃ and polymer free electrolyte are mixed ion conductors, predominantly with anionic conductivity. Ionic conductivity of the composite electrolyte, (PEO)₉CuCNS+10wt%Al₂O₃ has enhanced substantially due to the presence of Al₂O₃ filler at temperatures above as well as below the PEO crystallite melting temperature (~ 60°C). This enhancement can be attributed to the creation of additional sites and favourable conducting pathways due to Hbonding between ClO₄ and OH groups at Al₂O₃ grain surface. Another important conclusion that can be arrived from these observations is that the anionic transference number is significantly increased due to the addition of Al₂O₃.