STUDY OF THE ELECTRICAL PROPERTIES OF A POLYMER (CPVC) DOPED WITH ORGANIC COMPOUNDS

THESIS

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ABSTRACT

The present work is concerned with the study of some electrical properties of chlorinated polyvinyl chloride (Cpvc) doped with organic compounds {(Ethyl (P-methoxy -2- cyano cinnemate)}, (1-Diazo Phenyl – 1- chloro acetate). Sample were prepared by using slandered casting method.

The dc-conductivity, dielectrie constant and thermally stimulated discharge current (TSDC) measurement were carried out on both series (CPVC + 1,2 and 3 Wt% Of ethyl (P-methoxy -2- cyano cinnemate And Of (1- Diaso Phenyl 1- chloro Acetate).

The dc-conductivity (σ_{dc}) observed at high temperatures from (300-400K) for the doped samples with (1- Diaso Phenyl 1- Chloro Acetate)} showed increased value as compared to those obtained from Ethyl (P-methoxy -2- cyano cinnemate). It was also observed that σ_{dc} is = 1×10^{-10} $(\Omega cm)^{-1}$ at 385K for pure CPVC , on increasing the additive (1- Diaso Phenyl 1- Chloro Acetate) concentration up to 3wt% σ_{dc} reaches a value of 5×10^{-9} $(\Omega cm)^{-1}$ at the same temperature.

The dielectric constant measurements were carried out in the temperature range 300-420K and frequencies from 1 kHz – 1MHz. A single relaxation peak denoted as α-peak was obtained. This peak was analysed and was found to be of dipolar nature. The

addition of the organic compounds up to 3 wt% changes the position of the α- relaxation peak and also increases its half –peak width.

The dielectric constant ε' (T) showed a region that increases slowly at the low temperature end and this could be taken as estimate for ε_0 .The increase in ε' beyond this region may be due to electrode polarization or ionic contribution. On increasing frequency the dielectric loss peak shifted to higher temperature while the peak height tended to higher values. The maximum loss obtained at ωt=1. Cole-Cole plots were employed to calculate both the activation energies and relaxation time of the prepared samples.

Thermally stimulated depolarization current TSDC, has been used to investigate the dielectric relaxation phenomena of pure and doped samples which lead to determine its glass transition temperature at low frequencies (=10^{-3} Hz). TSDC showed a single relaxation process (α- relaxation) for pure and doped samples with different concentration (1, 2 and 3wt %) of the additive. The obtained TSDC data had its highest value (0.34μA) for CPVC doped with 3wt% (1- Diaso Phenyl 1- chloro acetate), while it reaches (0.3μA) for CPVC doped with 3wt% ethyl (P-Methoxy -2- cyano cinnemate). These values of the TSDC obtained for doped samples were marginally

larger as compared with those for pure samples (0.005μA).

The effect of polarizing time (t_p) on the TSDC for pure CPVC and doped sample were studied. TSDC peaks were found to be affected by (t_p) as well as the additive concentration ratio. The possible origin of the spontaneously generated current could be related to the C-CL dipolar groups orientations.

The activation energies were calculated by using, the initial rise and the Gross – Weiner methods. The values of activation energies as calculated from the two techniques were found to be nearly close to each other.