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Dielectric Spectroscopy of Pure and Doped Thin Film for Advanced Applications

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***Abstract-* Dielectric spectroscopy of pure and doped PVK sample has been studied. Sample forms using thin film technology. Dielectric study is performed in pure and PVK doped samples. Excellent changes found after incorporate of malachite green in PVK matrics.**

Keywords: PVK, band gap, UV, CTC.

1. INTRODUCTION

Polymers play dominant role in present life. All parameters were calculated using existing method. All parameters are within the surface range. [1-5].

Studies on polymers have attracted a particular attention due to their useful mechanical properties, unique disordered structure and their potential applications in many technological and engineering areas. The miniaturization of solid state devices has opened up yet another new field for use of polymers, which is very vast, fascinating and promising [6-11].

2. EXPERIMENTS CONDUCTED

The dielectric constant and dielectric losses of polyvinyl carbazole (PVK) and malachite green doped PVK samples are observed in the temperature 40-70^{0}C and frequency (500 Hz to 20 kHz) range. An Agilent 4284A hi gh precision LCR meter was used to measure the dielectric constant of polymeric foil samples. A sample of known thickness and dimension of 2 x 2 cm^2 was electrode on both the sides by using vacuum aluminization technique. The electrode area was measured to be as 1 x 1 cm^2. This sample was placed between two brass plated stainless steel electrodes of a circular Teflon holder connected to the LCR meter, and then the holder and the sample were placed in the furnace. The experimental observation were taken all polymeric samples were heated with a heating rate of 3°C/min and a step temperature of 5°C.

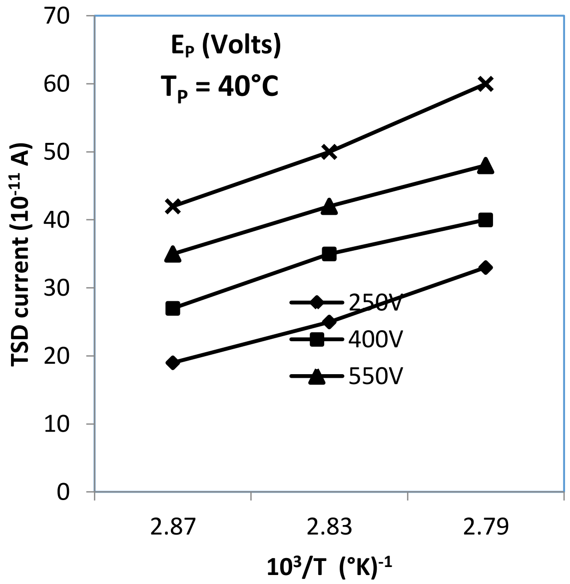

Figure 1: Initial rise plots of pure PVK samples poled at 40°C with different polarizing fields (i.e. 250, 400, 550 and 700 volts).

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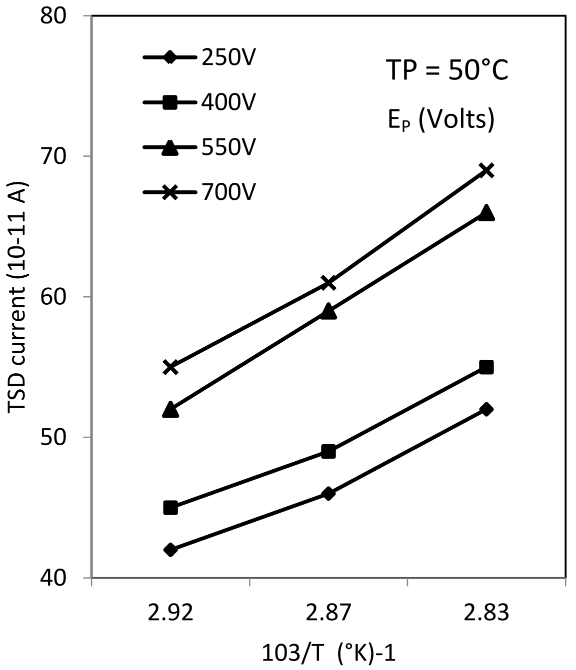

Figure 2: Initial rise plots of pure PVK samples poled at 50°C with different polarizing fields (i.e. 250, 400, 550 and 700 volts).

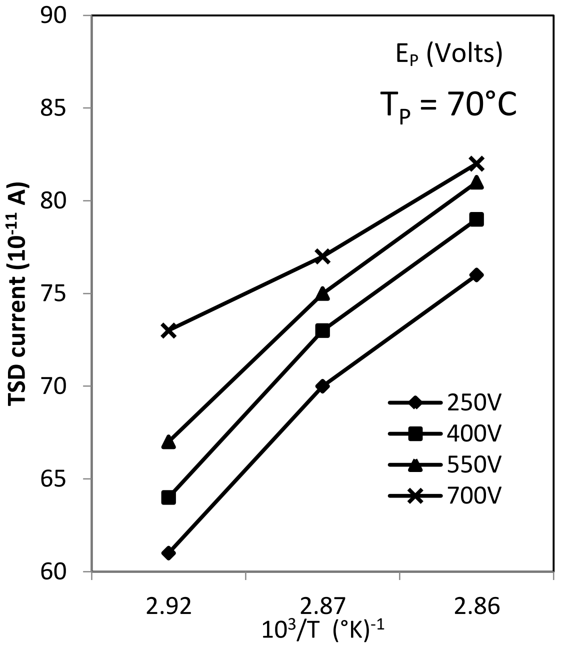

Figure 4: Initial rise plots of pure PVK samples poled at 70°C with different polarizing fields (i.e. 250, 400, 550 and 700 volts).

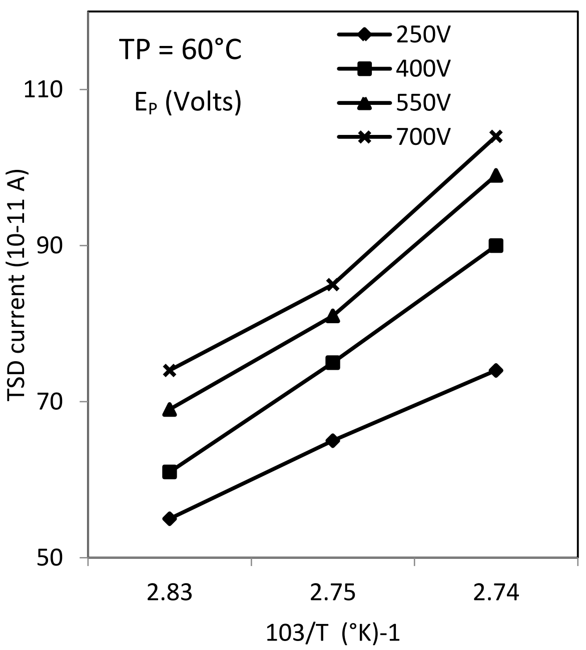

Figure 3: Initial rise plots of pure PVK samples poled at 60°C with different polarizing fields (i.e. 250, 400, 550 and 700 volts).

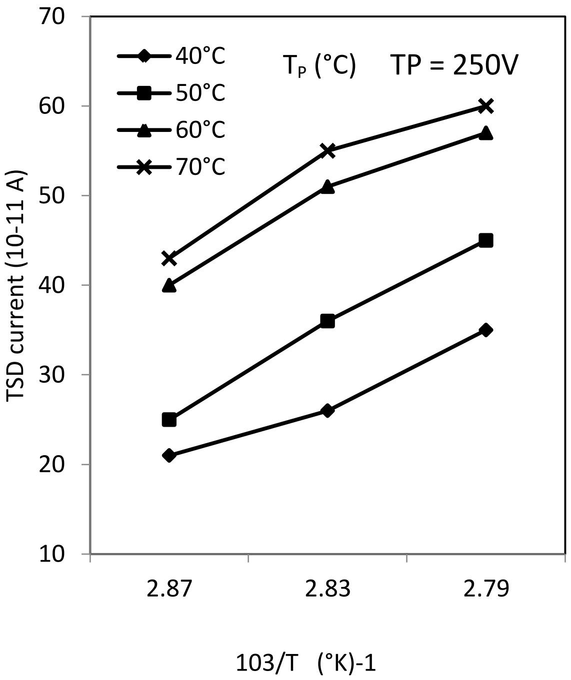

Figure 5: Initial rise plots of pure PVK samples poled at 250 volts with different polarizing temperatures (i.e. 40, 50, 60 and 70°C).

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3. RESULTS AND DISCUSSION

This phenomenon is also known as 'the expense' or 'loss' of power, meaning an average electric power dissipated in matter during a certain interval of time. As distinct from conductors, most of the dielectrics display a characteristic feature: under a given voltage the dissipation of power in these dielectrics depends on the voltage. Dielectric losses are the amount of power lost in a dielectric due to the action of the voltage applied to it. This is the general term for determining power loss in an electric insulation at both direct and alternating voltage. Initial rise plot of pure and doped PVK in shown in figures 1 to 5. Plots represents the storage in the polymer matrix. The dielectric loss angle is an important parameter for both the dielectric material and the insulated portion. All other conditions being equal, dielectric losses increase with the loss tangent. The quality factor of an insulation portion, i.e. the value reciprocal of the loss tangent, is sometimes determined.

The maximum in dielectric loss occurs at temperatures at which motion of large segments of the main chain or different polar side groups begins. Thus, these temperatures are related to the temperature at which the same transitions are observed in mechanical studies (at the same frequency). These are, however, cases in which transition temperature differ considerably. This may result from different fields acting in both these cases. Dielectric behavior of high polymers is generally characterized by the distribution of relaxation times. These distributions may be obtained by the procedure applied to obtain distributions of mechanical relaxation times in many cases they are similar but not identical [12-16]. It is also clear that the value of dielectric constant decreases with decrease in temperature.

With increasing frequency dielectric constant decreases. In general with increasing temperature the value of dielectric constant increases upto 64^0C and beyond that it decreases for both pure and malachite green doped samples.

Curve of dielectric losses sharply decays for PVK samples as temperature increases. The value of dielectric losses for malachite green doped PVK samples decreases upto 10 kHz and then increases for higher value of frequency (i.e. 20 kHz) at all the temperatures. In general dielectric loss decreases with decrease in temperature.

Dielectric losses firstly upto 50^0C and then increases with further increase in temperature for both pure and malachite green doped PVK samples[17-21].

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