THERMO AND PHOTOINDUCED CHARGE CARRIER GENERATION AND TRAPPING IN DIELECTRIC MATERIALS

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ABSTRACT

The phenomena of thermo and photoinduced charge carrier generation and trapping in various dielectrics have been studied.

The origin of spontaneous current emission (SCE) from metal-dielectric (hygroscopic)-metal sandwiches has been explored. SCE from cellulosic materials has been studied in detail. The current thermogram has been explained in terms of the processes going on as the sample is heated. The peak (at around 100^{o}C) in the current thermogram is attributed to the thermoinduced desorption of sorbed water. The second rise in current, at above 150^{o}C, is attributed to dehydration of water from equatorial hydroxyl groups in the cellulosic units. The time-interval between the heatings (or the amount of sorbed water) is found to play a decisive role as regards the magnitude of current during a repeated heating. The conductance thermogram is seen to be similar in shape to the current thermograms. Cellulosic materials rich in water content have been found to generate current of the order of 10^{-5}A even without heating. Electrochemical reaction of water, contained in (or liberated from) the sample, with metallic electrodes causes the current. The argument put forward to explain the current thermogram

of cellulose has been verified by studying two other hygroscopic dielectrics viz. poly (vinyl Alcohol) and Nickel Sulphate (hydrated). Thermoinduced SCE has been proved to be a simple method of finding the deaquation temperatures of hygroscopic materials.

Thermally stimulated discharge current studies (TSDC) in cellulose thermoelectrets have been performed. A method of isolating the actual depolarisation current from spontaneous current component has been developed and successfully applied. Depolarisation Kinetic Data have been evaluated. The origin of polarisation has been probed.

A promising organic material viz. Michler's Ketone, in the form of binder layers, has been studied for photoinduced charge carrier generation and trapping phenomena viz photoconductivity and photoelectret state. This material produces a voltage (>1.0 volt) under illumination which persists in dark i.e. it shows autophotoelectret state as well.

Transfer electrophotographic studies in a mixed system of binder layer viz. HgS:CdS have been performed. The binder layer having 80:20 ratio of HgS: CdS has been found to show optimum xerographic characteristics. A Master Plate has been developed. Transfer and PIP electrophotographic studies in Michler's Ketone binder layers have also been performed.

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