The dielectric properties of ethyl cellulose composites

Eknath Nivrtirao and Basavaraja Sannakki
Department of Post Graduate Studies and Research in Physics, Gulbarga University, Gulbarga, 585106, Karnataka

Abstract- We studied the dielectric constant and a. c. conductivity measurements of Ethyl cellulose blends with Polyvinyl pyrrolidone of various weight percentages as a function of frequency over the range 50 Hz – 5 MHz at room temperature.

INTRODUCTION

It is well known that the composites of polymers and their blends exhibit enhanced properties than that of the constituent materials [1, 2]. The polymer blends are combination of different polymer-matrix composites, a material important to the electronic industry for its dielectric properties in the use of capacitors [3]. One of the most characteristic features is that of their dielectric properties and that can be widely changed by choice of shape, size and conductivity of mixed constituents in the polymeric matrix [4]. The study of dielectric constant, dielectric loss and a. c. conductivity, as function of frequency is one of the most convenient and sensitive methods of studying the polymeric structure [5]. The physical structure is of great importance in determining the dielectric behavior.

EXPERIMENTAL

Polymers of Ethyl Cellulose (EC) and Polyvinyl Pyrrolidone (PVP) were obtained from S.d. Fine Chem Ltd, Mumbai, India. The different quantities of ethyl cellulose substances have been used for preparing pellets of different thickness. The circular shapes of pellets have been made by applying 2-3 tons of pressure using the pellet making machine. Further, blends of the ethyl cellulose were obtained by mixing with different weight percent. The pellets were coated with silver paint for Ohmic contacts to provide electrical connections. The measurement of capacitance and dielectric constant, as a function of frequency ranging from 50 Hz - 5 MHz at room temperature using PC based LCR meter (Model: HIOKI 3552-50-LCR Hitester).

RESULT AND DISCUSSION

The dielectric constants of ethyl cellulose with its blends of polyvinyl pyrrolidone as a function of frequency are shown in fig 1. The dielectric constant of Ethyl cellulose blends oscillates at lower frequency range 50 Hz – 100 Hz for all the thicknesses of the samples and at frequency above 200 Hz the dielectric constant remains same as the frequency increases up to 5 M Hz.

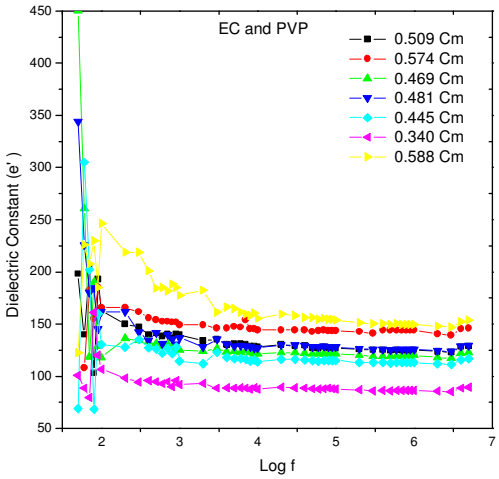

Fig. 1-The dielectric constant of ethyl cellulose blends with PVP.

Here we noticed that the dielectric constant of polymer blends of Ethyl cellulose with polyvinyl pyrrolidone increases as the wt% increases. Here we observed that at frequency 200 Hz as thickness increase the dielectric constant also increases. The a. c. conductivity of Ethyl cellulose blends is shown in fig 2.

The a. c. conductivity remains constant up to 300 kHz and afterwards it increases exponentially as frequency increases and peak is observed around 3 MHz. Here we observed that, after 300 kHz, as the wt% of PVP increases the conductivity decreases.

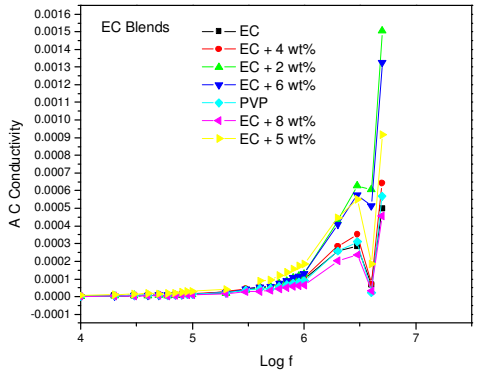

Fig. 2- A C conductivity of ethyl cellulose and its blends with PVP.

REFERENCES

1. Ronald J Gutmann, IEEE Trans. Microwave Theory Tech, 47 (1991), 667.
2. Akram M, Javed A and Rizvi T Z, Turk J Phys, 29 (2005) 355-362.
3. Radhakrishnan S, Proceeding of Nat. conf on Recent trends in composites (2001).
4. Ferroro J R and Walkar A, J Chem. Phys. 42, (1965) 1273.
5. Kimura T and Kajiwara M, J Mater. Sci. 33, (1998) 2955.