Effect of Lithium Fluoride on Dielectric Properties of Polystyrene

Dr. Asrar Abdul Muniam Ahmed Hashim
Al-Mustansiriyah University, College of Science

الخلاصة

تم في هذا البحث دراسة تأثير إضافة فلوريد الليثيوم على الخـــواص العزلية للبولي ستايرين . ولهذا الغرض تم تحضير نماذج بإضافة LiF الى PS و بنسب حجمية مختلفة من هذه الاملاح .

اشارت النتائج الى ان ثابت العـــزل , الفقـــدان العزلـــي و التوصـــيلية الكهربائية المتناوبة تتغير بتغير النسبة الحجمية للملح المضاف و تردد المجال الكهربائي المسلط .

Abstract

In the present work, effect of addition Lithium Fluoride on dielectric properties of polystyrene has been investigated .For that purpose ,the PS samples with LiF additive are prepared with different percentages and different thickness.The experimental results showed that the dielectric constant, dielectric loss, AC electrical conductivity have changed with changing the concentration of additional salts and frequency of applied electrical field

Introduction

Polymers have traditionally been considered as insulating materials by chemists and physicists alike . A conducting polymer is chewable and desirable . A light weight ready moldable , desirable conductive material has long been recognized as a worthwhile goal to work for[1,2].Researches, generally, have demonstrated that conductive polymers can be used as energy storage element in:[3,4]

1- Capacitors and Secondary batteries .
2- As semiconductor material in schotty diode.
3- Insulated gate field effect transitions (FET) and light emitting diodes.

4- As conductive layer for electromagnetic shielding (EMI) and electrostatic protection.

Intensive studies have been carried out on conductive polymer composites owing to their potential applications as antistatic materials , self-regulating heaters , gas sensor, etc. It is found that the electrical performance of the materials is highly dependent on composites microstructure in addition to the nature of fillers[5]. This paper deals with results of the effect of LiF on the dielectric constant , dielectric loss and electrical conductivity of the PS-LiF composites over a range of frequency.

Experimental work

The materials used in the paper is polystyrene as matrix and Lithium florid as a filler.

The electronic balanced of accuracy 10^{-4} have been used to obtain a weight amount of LiF powder and polymer powder . These mixed by Hand Lay up and the Microscopic Examination are used to obtain homogenized mixture .The volume percentages of LiF which eguivalent weight percentages are (0,14.6,17.66,21,24.6,28.5,32.75,37.4 and 39.4) vol% The Hot Press mothed is used to pressure the powder mixture. The mixture of different LiF percentages has been compacted at temperature 145C^{o} under a pressure 100 par for 10 minutes . Its cooled to room temperature , the samples were disc shap of a diameter about 30mm and thickness ranged between (1.75-2.2) mm.

The dielectric properties of PS-LiF composites were measured using (Agilent impedance analyzer 4294A).

In the frequency range 40-1.5×10^{6} Hz at room temperature. The measured capacitance, C(w) was used to calculate the dielectric constant ,έ(w) using the following expression:

$$\acute{\varepsilon}(w) = C(w)\ \frac{d}{\varepsilon_o A} \qquad (1)$$

Where d is sample thickness and A is surface area of the sample .

whereas for dielectric loss ε"(w) :

$$\varepsilon''(w) = \acute{\varepsilon}(w) \times \tan\delta(w) \qquad (2)$$

Where tanδ(w) is dissipation factor .

The AC σ_{ac} can be calculated by the following equation :

conductivity