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Studying the Effect of KCl Addition on the Electrical Properties of Polystyrene

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Abstract

In this work, samples of pure polystyrene and polystyrene (PS) doped with (KCl) were prepared using casting method .The effect of addition of different concentrations of potassium chloride on electrical properties of polystyrene have been studied, also the effect of temperature on (PS-KCl) composite , then the variation of activation energy of D.C electrical conductivity with KCl concentrations was studied. The results show that the electrical conductivity was increased with increasing the KCl concentration and temperature and the activation energy was decreased with increasing KCl concentration.

Key words: polymer, PS, potassium chloride, electrical properties, conductivity.

دراسة تاثير اضافة KCl على الخواص الكهربائية للبولي ستايرين

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الخلاصة:

في هذا البحث تم تحضير نماذج من بولي الستايرين النقي والبولي ستايرين المشوب ب KCl باستخدام طريقة الصب. ودرس تأثير اضافة تراكيز من مادة كلوريد البوتاسيوم على الخواص الكهربائية للبولي ستايرين , كذلك تاثير تغير

1. Introduction

In the recent years, studies on the electrical properties of polymers have attracted much attention because of their application in electronic devices. Electrical conduction in polymers has been studied aiming to understand the nature of the charge transport prevalent in these materials [1]. The structure of polymers has been related to internal pressure and the same study has been extended to polystyrene solutions. Some of the interesting properties of polystyrene like the Gruneissen parameter, specific heat and bulk modulus have also been reported [2]. Polystyrene (PS) is amorphous polymer with bulky side groups. General purposes PS is hard, rigid, and transparent at room temperature and glass like thermoplastic material which can be soften and distort under heat. It is soluble in aromatic hydrocarbon solvents, cyclohexane and chlorinated hydrocarbons [3].
The optical constants are very important because they describe the optical behavior of the materials. The absorption coefficient of the material is very strong function of photon energy and band gap energy [4].
The present study will help in understanding the effect of different concentrations of potassium salt on the D.C conductivity.

2. Experimental Part

Polystyrene solution was prepared by dissolving it in cloroform by using magnetic stirrer in mixing process to get homogeneous solution. The concentrations of KCl are (4, 8 and 12) wt. % were added and mixed for 10 minute to get more homogenous solution.

Casting Method was applied by using Petri dish that leaved to dry at room temperature for three days. The dried film was then removed easily by using tweezers clamp.

3. Results & Discussion

3.1 The D.C electrical conductivity

The variation of D.C electrical conductivity of polystyrene with different concentrations of salt is shown in figure(1), it is found that the electrical conductivity was increased with increasing the concentration of salt. The increase of conductivity attributed to increase the ions in composites.

3.2 D.C electrical conductivity with Temperatures

Fig. (2) shows the variation of D.C electrical conductivity of composite with different temperature of different concentrations of salt. The electrical conductivity was increased with increasing temperature, this behavior due to increase the movement of polymer chains with increase the temperature.

3.3 Activation Energy

Fig. (4) shows the variation of activation energy of D.C electrical conductivity of polystyrene with the concentration of salt, it is found that the activation energy was decreased with increasing the concentration, this due to increase the local levels in forbidden energy gap.

Conclusion

The addition of potassium chloride concentration was effected on electrical properties of polystyrene. It is found that the electrical conductivity was increased with increasing the concentration of salt and temperature, also activation energy was decreased with increasing the concentration.

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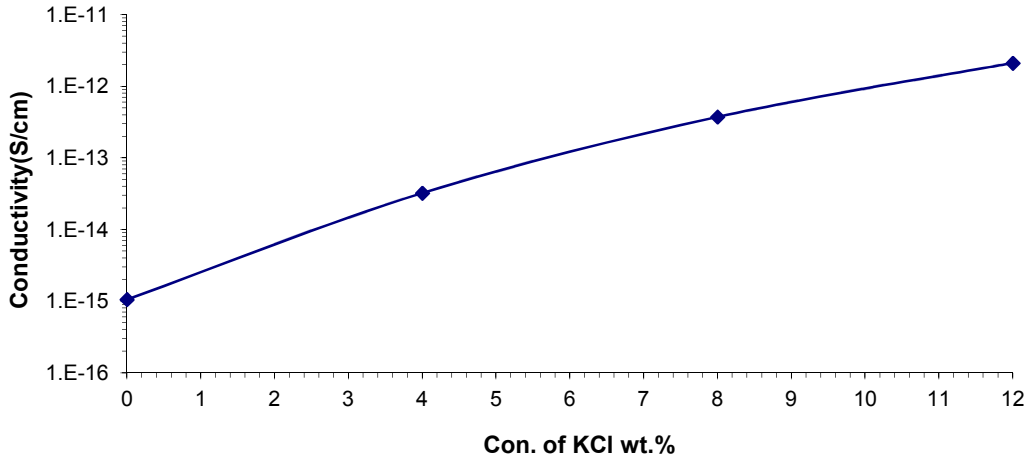

FIG.1
Variation of D.C electrical conductivity with KCl wt.% concentration of composite.

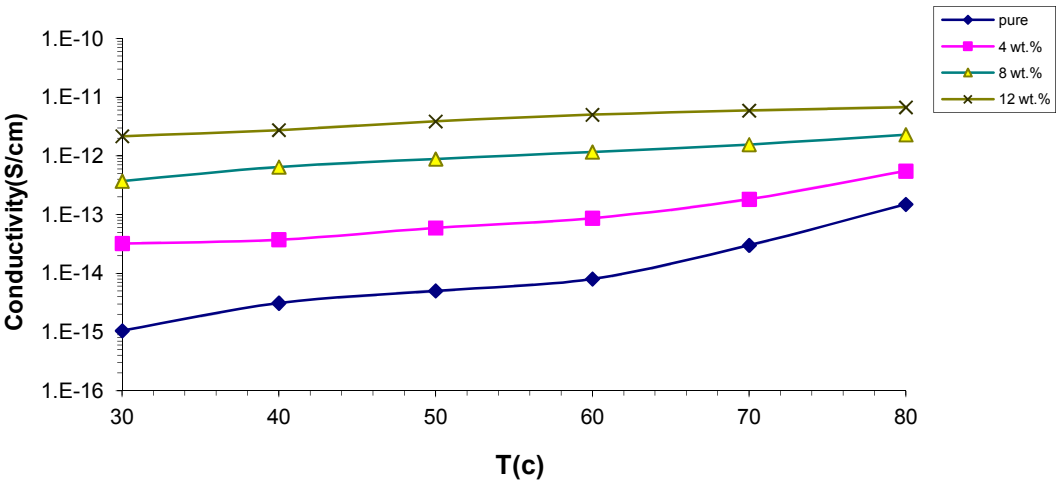

FIG.2
Variation of D.C electrical conductivity with temperature for(PS-KCl) composite

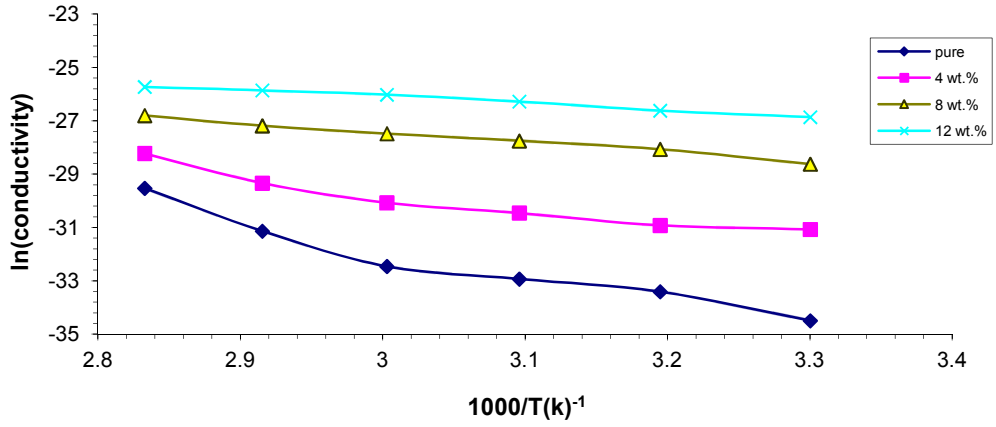

FIG.3
Variation of D.C electrical conductivity with resprocal absoute temperature for (PS-KCl) composite.

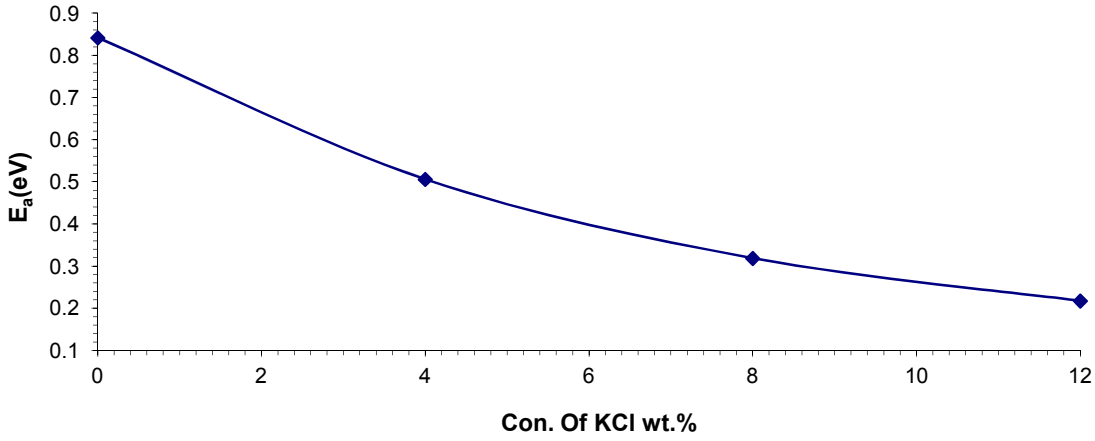

FIG.4
Variation activation energy for D.C electrical conductivity with KCl concentration of composite

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