

## Thermal Studies of Modified and Unmodified Polyesterene

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### Abstract

Radiation induced modified polystyrene(PS) has been investigated by Differential Scanning Calorimetry. DSC thermogram of unmodified PS has shown first order transition around 80<sup>0</sup>C on irradiation a change in the peak shifted to low temperature indicate the decrease of PS on gamma irradiation.

Key words: PS(polystyrene), gamma irradiation, DSC( Differential scanning calorimetry)

### Introduction

Polystyrene(PS) is one of the important industrial plastic employed in different applications. Modification of chemical structure of PS by various methods like chemical modification, radiation modification are very important (1-2). Radiation induced modification of PS is an important aspect as there are no side effects and extra costs(3-5). In this context the authors have reported on the chemical changes induced gamma irradiation using FTIR technique(6).

### Experimental

Polystyrene in the form of granules is of commercial origin. It is dissolved in toluene and thin film of PS with different thickness are prepared by slow evaporation of concentrated solutions of PS. Gamma irradiation are carried out using Cobalt 60  $\gamma$ -radiation source at a dose rate of 15kGy/hr in air at room temperature, the dose administered to the sample is controlled by time of exposure of sample to radiation. DSC thermogram are recorded on Meitler Calorimeter for thin films of PS. 5-10mg of PS are kept in alluminium pans and sealed with empty alluminium pan is kept as reference. The pans were heated with a rate of 10<sup>0</sup>C/min

in the temperature range of room temperature to 300°C.

## Results and Discussion

DSC thermogram of unmodified PS is as shown in Fig1. The thermogram posses various first order transition at 80°C the first order transition is assigned to glass transition temperature of the polymer.

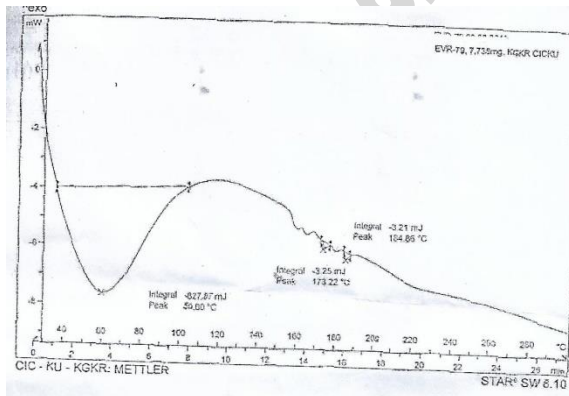


Fig 1. DSC spectrum of un-irradiated PS

These absorption bands are assigned to various chemical moities as given in Table1.

$T_p$ value(K)	$\Delta H$ value(K J/mol)	T onset( K)	$\Delta\omega$ (K)	$\Delta HF$ M (K)
342	627	355	40	35

**Table: Functional group analysis of PS**

Considering the chemical structure of PS the chain cleavage do not occur on pendent aromatic groups, instead the chain cleavage occur at the methyne group of

polymer. The result is inconsistent with ESR spectra observed by various authors(2-6) who proposed the chain cleavage occurs at the proton position of PS main chain forming  $\sim\text{CH}_2-\dot{\text{C}}(\text{C}_6\text{H}_5)-\text{CH}_2\sim$  radicals.

Formation of such type of free radicals will make the polymer to undergo crosslinking type reaction rather than degradation.

## Conclusion

In conclusion modification of PS by gamma irradiation leads to cleavage of side groups and the formation of free radical(I). in the event of I, the PS preferably undergo cross linking reactions. The PS in its cross linked form have more mechanical properties making suitable for high stress applications. Glass transition temperature of PS decreases on irradiation.

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