

**Gamma Irradiation Effects on Optical and Electrical
Properties for (polyethylene-polyvinyl acetate)
Copolymer**

Thesis

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Abstract

This thesis shows the influence of γ -irradiation on the structure, optical, and electrical properties of ethylene-vinyl acetate Copolymer (EVA). Studies were performed using differential scanning calorimetry, X-ray diffraction, IR spectroscopy, UV-visible spectroscopy, dielectric constant, dielectric loss tangent and ac electrical conductivity.

Thermal analysis employing DSC technique was used to study the change of the melting point and the glass transition temperature upon γ -irradiation. The obtained results indicates that the crystalline structure of EVA is essentially sustained and the irregular trend of T_g with increasing γ -dose can be attributed to whether degradation or crosslinking processes is predominant.

X-ray diffraction was used to determine the crystallinity of unirradiated and irradiated EVA copolymer. Samples irradiated with 5, 10 and 100 kGy γ -doses showed a maximum degree of crystallinity.

Careful examination of the IR spectra indicates that 5, 10 and 100 kGy γ -doses culminate in changes in intensity, position, broadening of the absorption bands overlapping and disappearance of bands. The crystallinity index for 5, 10 and 100 kGy irradiated samples is larger than the un irradiated one.

Analysis of the UV spectra indicate that a new band has appeared in the range 240-280 nm upon γ -irradiation. The disappearance of the absorption shoulder at 350 nm for 5, 10 and 100 kGy irradiated EVA

samples may be due to modifications in molecular structure introduced as a result of the scission of side chain ester groups in PVAc. The optical energy gaps and band tails of EVA samples at different γ -doses are estimated.

A study of the color parameters as a function of γ -doses (5-100 kGy) for EVA is presented. The calculated tristimulus values, color indices and color scales are found to be γ -dose dependent.

The dielectric properties of EVA copolymer were investigated by measuring the dielectric constant, ϵ' , dielectric loss tangent ($\tan \delta$) and ac electrical conductivity in the frequency range 0.4-100 kHz at different temperatures ranging from ambient to 86 °C. Effect of γ -irradiation on ϵ' and $\tan \delta$ has been observed and discussed. It has been found that the unirradiated EVA has only one relaxation peak namely α -peak. An additional relaxation has appeared in ϵ' (T) curve for all γ -doses except 100kGy γ -dose. Also, $\tan \delta$ (T) curves for 5, 10 and 100 kGy showed a new relaxation peak at higher temperatures.

The frequency dependent conductivity of 10 kGy irradiated sample was examined. It was found that the correlated hopping mechanism of electron appeared to be operative.