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INFLUENCE OF γ-RADIATION ON STRUCTURE OF HIGH DENSITY POLYETHYLENE COMPOSITES WITH GaAs AND GaAs <Te> FILLERS

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INFLUENCE OF γ-RADIATION ON STRUCTURE OF HIGH DENSITY POLYETHYLENE COMPOSITES WITH GaAs AND GaAs <Te> FILLERS
G.B.Ahmadova
Institute of Physics of ANAS, Baku, AZ 1143, Azerbaijan
gunayehmedova12@gmail.com
This paper presents the results of Fourier-IR spectroscopic studies of γ-radiation effect on the structure of composite films of high density polyethylene (HDPE) with semiconductor fillers of gallium arsenide (GaAs) and gallium arsenide doped with tellurium (GaAs <Te>) at room temperature. IR spectroscopy allows one to follow structural changes due to the influence of gamma radiation and identify patterns associated with these changes.
A homogeneous mixture was prepared from HDPE and GaAs and GaAs <Te> semiconductors powders (with particle size ⊠50 micron) through mechanical mixing. Then samples were exposed to hot pressing at T = 413 K temperature within15 minutes and cooled to room temperature within 30 min.
The samples were irradiated with γ-rays from a 60Co source at room temperature with a dose rate of 1.05 Gy / s. The absorbed dose was Φγ = 5-150 kGy.
The Fourier-IR absorption spectra of the initial and γ-irradiated composite samples were recorded on a Varian 640 FT-IR spectrometer at room temperature in the frequency range 4000–400 cm–1. Structural changes associated with the influence of γ radiation were observed in the frequency range 750–700 cm–1, corresponding to the pendulum vibration of the CH2 group of HDPE. The band at 730 cm–1 characterizes crystalline regions, and the band at 720 cm–1 characterizes crystallites + amorphous layers.
The crystallinity degree of the samples was calculated based on the optical densities by the following formula :
K=
where D730 and D720 are optical density of 730 and 720 cm-1 bands in the IR spectra of HDPE + GaAs and HDPE + GaAs <Te> films respectively.
The degree of crystallinity and their correlation along the absorption bands with maximum at 720 and 730 cm-1 were determined. By the dose dependence of the relative degree of crystallinity, it was found that in the absorbed dose range Φγ = 5-150 kGy, the HDPE / GaAs <Te> composites are the most radiation-resistant in comparison with the HDPE / GaAs composites.

Author: Ms AHMADOVA, Gunay

Presenter: Ms AHMADOVA, Gunay

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