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Radio-thermo-luminescence and Dielectric Relaxation of Virgin and Recycled Polypropylene

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The temperature dependence of dielectric relaxation and γ -irradiation stimulated thermo-luminescence (RTL) for virgin and recycled polypropylenes (PP) has been investigated. The dielectric loss study was performed using E8-4 bridge. The testing temperature was varied from -150 to 120°C at a heating rate of 2 K/min and a frequency of 1 kHz . The PP samples were γ -irradiated in nitrogen liquid (γ - source Co^{60} with energy of 1.25 MeV).

The measurement data shows that the dielectric losses did not appear in minus temperature region for the initial polypropylene samples and the RTL occurs only in minus temperature region and there are several luminescence peaks, essential intensity raise and the intensity peak shift to higher temperatures for the recycling polymer.

As far as our measurement shows slow dielectric losses in temperature region of luminescence appearing then it can conclude that the luminescence peaks connected mainly with small-scale molecular groups mobility without visible polar groups mobility contribution.

In recycling polypropylene on IR spectroscopy data there is visible defects quantity, OH and other polar molecular groupings mainly inter-molecularly associated by hydrogen bonds. It lead to quantity radical and electron traps increasing. By this can explain the luminescence intensity increasing for the polymer materials, and the peaks shift to higher temperature by hydrogen bonds hindered molecular groups mobility and going out of radicals and charges (electrons) from the traps. In the luminescence in high temperature regions introduce contribution thermo-mobility of macromolecular segments with polar molecular groupings.

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