MOLECULAR DYNAMICS IN POLY(ETHYLENE TEREPHTHALATE) (PET) AND POLY(ETHYLENE TEREPHTHALATE)-GLYCOL (PETG)

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The work presents the studies of molecular motions in two polymers poly(ethylene terephthalate) (PET) and amorphous copolymer of PET poly(ethylene terephthalate)-glycol (PETG) by solid-state NMR techniques. These polymers have a great commercial and industrial application in fibers, food containers, bottles, pharmaceutical packagings, toys etc [1, 2, 3]. The structures of these studied compounds were presented in Fig. 1.

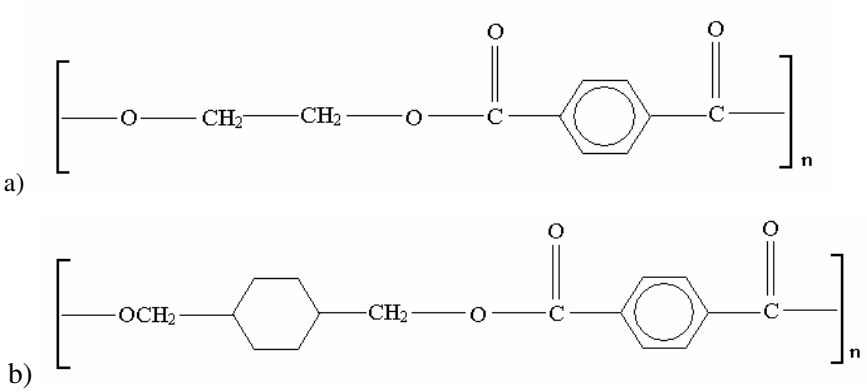

Fig. 1. Structure of a) PET b) PETG.

The NMR methods were used to investigate the molecular dynamics. The spin – lattice proton T_1 measurements were carried out on home made pulse spectrometer operating at 30.2 MHz, using a saturation sequence and "solid echo" to shorten the recovery time. The recovery of magnetization was single exponential. The temperature dependences of proton spin-lattice relaxation time T_1 for PET and PETG were shown in Fig.2. The second method of ^{1}H NMR lines was calculated from results of measurements performed on continuous wave spectrometer operating at 25 MHz. All experiments were conducted in temperature range from 140 to 375 K. Figure 3 shows the temperature dependence of the second moment of ^{1}H NMR line M_2 for both of researching polymers. The model of internal dynamics was discussed.

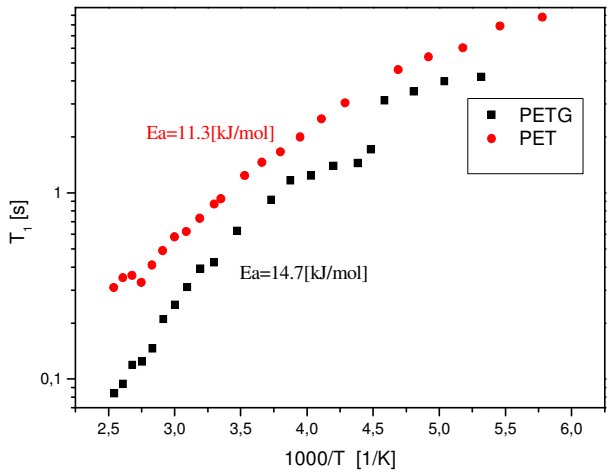

Fig.2. The temperature dependences of ^{1}H NMR spin-lattice relaxation time T_1 for PET and PETG, respectively.

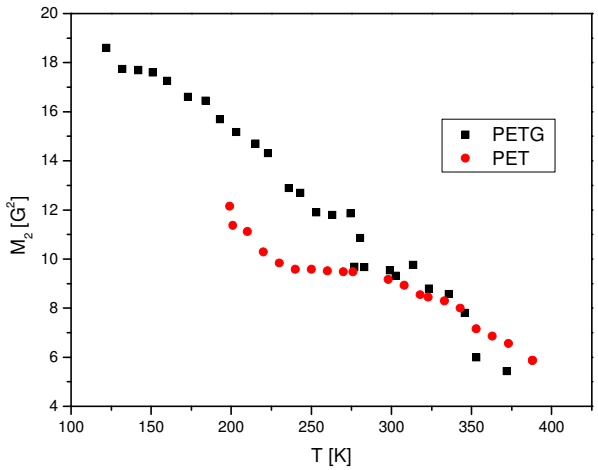

Fig.3. The temperature dependence of the second moment M_2 of ^{1}H NMR line of PET and PETG, respectively.

References:

[1] C. P. Papadopoulou and N. K. Kalfoglou, *Compatibility behaviour of blends of poly(ethylene terephthalate) with an amorphous copolyester*, POLYMER 38, Number 3, (1997).

[2] R.B. Dupaix, M. C. Boyce, *Finite strain behavior of poly(ethylene terephthalate) (PET) and poly(ethylene terephthalate)-glycol (PETG),* POLYMER 46 4827-4838 (2005).

[3] A. R. Donovan, G. Moad, *A novel method for determination of polyester end-groups by NMR spectroskopy,* POLYMER 46 5005-5011 (2005).