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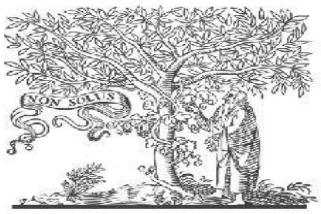

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INFLUENCE OF VARIOUS FILLERS ON THERMAL PROPERTIES OF A POLYETHYLENE MATRIX

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Abstract: The degree of crystallinity of LDPE at the first melting is in most cases somewhat higher than at the second, which is also explained by the size of the crystallites, since the smaller the crystals, the higher the index of the total degree of crystallinity.

Keywords: heat pressing, crystal, factions, melting and temperature.

Introduction

The effect of various fillers on the thermophysical properties of the polyethylene matrix was assessed by differential scanning calorimetry (DSC). To study the processes associated with physical transitions, the samples were melted twice (Table 1). During the primary heating of the samples, the temperature of the polyethylene melting peak turned out to be lower than during the secondary heating. Film samples were obtained by the method of heat pressing with rapid cooling. As is known, during rapid cooling, many small crystallites are formed [1]. In this regard, after the first melting in materials with slow cooling, larger and more perfect crystallites were formed, the melting temperature of which is higher than that of small crystallites [2]. The degree of crystallinity of LDPE at the first melting in most cases is slightly higher than at the second, which is also explained by the size of the crystallites, since the smaller the crystals, the higher the index of the total degree of crystallinity [3]. The added fillers act as nuclei of crystallization; therefore, the degree of crystallinity of polyethylene in materials with fillers is higher than in pure polymer. Differences in the degree of crystallinity of LDPE among filled composites are due to different degrees of dispersion of fillers. According to the data on the fractional composition of fillers, the most fine fraction (<80 μm) is found in powders from lignosulfonate, fire and leaves, and according to DSC data, a slightly higher degree of LDPE crystallinity is observed in compositions with these fillers. When considering a number of triple compositions containing sevilen, it can be noted that the tendencies established for double compositions persist. Table 1 shows the data on the maxima of the melting points and the degree of crystallinity in terms of the polyethylene content.

Table 1.
LDPE crystallinity (χ) and Tm. composites

Sample	First and second melting	Tm., °C, ±0,4	χ, % ±0, 5
LDPE	1	107,8	26,2
	2	108,4	25,3
Double compositions (polyethylene 70 wt% / filler 30 wt%)			
LDPE / banana	1	107,7	27,7
	2	106,9	30,6
LDPE / campfire	1	103,6	29,8
	2	105,0	29,7
LDPE / leaves	1	104,4	29,6
	2	107,7	27,1
LDPE / LS	1	104,8	29,3
	2	106,7	28,3
LDPE / husk	1	103,6	28,8
	2	104,8	26,8
LDPE / hay	1	106,9	27,7

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	2	107,7	26,0
Triple compositions (polyethylene 59.5 wt% / Sevilene 10.5 wt% / filler 30 wt%)			
LDPE / EVA / banana	1	106,9	31,2
	2	106,6	30,8
LDPE/EVA/ campfire	1	104,4	30,5
	2	106,9	28,8
LDPE / EVA / leaves	1	106,7	30,5
	2	106,5	26,8
LDPE / SEVA / LS	1	104,4	38,0
	2	106,9	30,5
LDPE / EVA / husk	1	104,4	29,5
	2	106,6	27,0
LDPE / EVA / hay	1	103,6	25,0
	2	104,4	26,0

Using the DSC method, the thermal stability of the obtained composite materials was also investigated. In fig. the DSC curves of the materials are shown. In this work, the study of materials in the temperature range from 125 to 160 ° C was of particular interest, since in this temperature range, the technological processes of mixing the components and manufacturing of products take place.

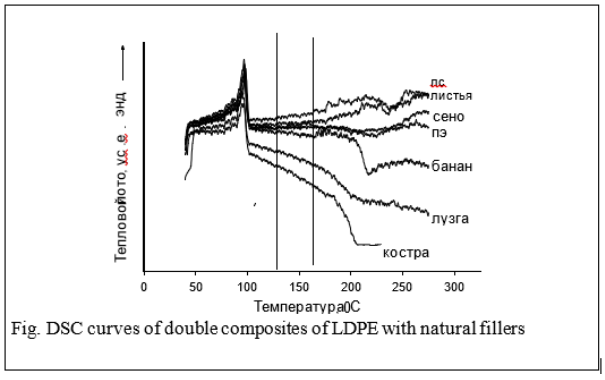

Fig. DSC curves of double composites of LDPE with natural fillers

The calculated values of the average value of the change in the heat flux in the investigated temperature range for the compositions are given in table. 2.

Table 2. Average change in heat flux in the temperature range 125-160 ° C for polyethylene composites with different fillers

Sample	PE / campfire	PE / husk	PE /banana code.	PE / hay	PE	PE / leaves	PE / LS
ΔdH/dtΔT	-54,2	-36,7	-17,8	-7,3	-7,1	-3,6	+2,2

For PE and mixtures of PE with hay and leaves, there is a slight change in the thermal effect with increasing temperature. For PE with fire and husk, the rate of change in the heat flux with temperature increases significantly. This parameter characterizes the initial stage of the exothermic process of polymer decomposition caused by its oxidation. There is a direct correlation between this characteristic obtained by the DSC method and the data on thermal oxidation of binary compositions at 130 ° C.

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