Supplementary Material

The introduction of fillers into polymers, including PP, leads to a change in both the operational and technological properties of polymer composite materials based on them. One of the prerequisites for the introduction of aluminum oxide into PCMs based on PP may be an increase in their thermal conductivity, which is important in the processing of PP-based products and their use, for example, for biomedical purposes. As follows from the data presented in Table S1, the values of the thermal conductivity coefficient of PP-aluminum oxide composites naturally increase with an increase in the proportion of filler. An increase in the thermal conductivity coefficient of PCM as compared to an individual PP may be due to the fact that in PP there are practically no free electrons available for thermal conduction mechanisms, and in the presence of aluminum oxide, heat propagation by thermal conductivity due to free electrons is quite possible.

Table S1. Dependences of the thermal conductivity coefficient of PCM PP-aluminum oxide on the amount of filler.

№	Content of aluminum oxide in PCM,%	Thermal conductivity coefficient, W/(m·K)
1	-	0.10 ± 0.01
2	0.1	0.11± 0.01
3	0.5	0.12 ± 0.01
4	1.0	0.14 ± 0.01
6	3.0	0.18 ± 0.02
7	5.0	0.19 ± 0.02
8	10.0	0.21± 0.02

In order to confirm the occurrence of photooxidative processes during accelerated aging, the data of two methods were used: modified iodometric analysis (to confirm the presence of hydroperoxide and peroxide groups in aged samples) and IR spectroscopy (to confirm the presence of decomposition products of hydroperoxide and peroxide groups — carbonyl-containing groups in aged samples).

The arithmetic mean of the results of five parallel experiments was taken as the result of iodometric analysis, the discrepancy between which does not exceed 5%.

IR spectra of pressed composite plates 1 mm thick were taken on an infrared spectrophotometer with Fourier transform with a special attachment for recording specular and diffuse reflectance spectra, the spectrum of the disturbed total internal reflection FTIR-8400S from Shimadzu.

To compare the degree of aging, this work uses IR spectroscopy and modified iodometric analysis.

The results of iodometric analysis are presented in Table S2.

Table S2. Concentration of hydroperoxide and peroxide groups in samples of composite materials based on PP and aluminum oxide before and after exposure in a climatic chamber.

№	Content of aluminum oxide in PCM,%	Concentration of hydroperoxide and peroxide groups, $C \cdot 10^{-4}$ mol / g				
		before exposure	after 2 days of accelerated aging	after 3 days of accelerated aging	after 4 days of accelerated aging	after 6 days of accelerated aging
1	-	0.256	0.512	0.641	0.815	0.945
2	0.1	0.235	0.501	0.629	0.841	0.955
3	0.5	0.220	0.530	0.618	0.819	0.971
4	1.0	0.235	0.560	0.632	0.832	0.949
5	3.0	0.212	0.497	0.622	0.824	0.922
6	5.0	0.215	0.501	0.613	0.811	0.920
7	10.0	0.201	0.498	0.607	0.810	0.908

As follows from the data given in the table, the content of peroxide and hydroperoxide groups in the samples of composite materials based on secondary polypropylene raw materials in the presence of aluminum oxide practically does not depend on the content of the latter and increases with an increase in the duration of accelerated aging. No clear influence of the presence of aluminum oxide on the induction period of PP photooxidation is observed.

The results of iodometric analysis are consistent with the data of the IR spectra. When comparing the IR spectra of composite samples based on PP and alumina before and after exposure in a climatic chamber, it was found that in aged composite samples, in addition to absorption bands characteristic of methyl, methylene, and vinylidene groups, the spectra contain a band at 1689 cm — 1 characteristic of a carbonyl conjugated with a double carbon-carbon bond, which may be due to photooxidative destruction under the action of UV radiation in air.

The results obtained on the change in the deformation and strength properties of PCMs based on PP and aluminum oxide as a result of accelerated aging under conditions close to natural ones may indicate structural transformations in the samples.

Indeed, as follows from the data given in Table S3, a slight increase in the degree of crystallinity is observed both with an increase in the content of aluminum oxide and with an increase in the duration of exposure in the climatic chamber, which is consistent with the literature data [15,16].

Table S3. The degree of crystallinity of the samples of composite materials based on PP and aluminum oxide before and after exposure in the climatic chamber.

№	Content of aluminum oxide in PCM,%	Crystallinity degree, %				
		before exposure	after 2 days of accelerated aging	after 3 days of accelerated aging	after 4 days of accelerated aging	after 6 days of accelerated aging
1	-	73 ± 4	75 ± 4	75 ± 4	77 ± 4	78 ± 4
2	0.1	73 ± 4	75 ± 4	76 ± 4	77 ± 4	79 ± 4
3	0.5	74 ± 4	76 ± 4	76 ± 4	78 ± 4	79 ± 4
4	1.0	74 ± 4	78 ± 4	79 ± 4	80 ± 4	81 ± 4
5	3.0	76 ± 4	79 ± 4	80 ± 4	82 ± 4	83 ± 4
6	5.0	79 ± 4	81 ± 4	83 ± 4	83 ± 4	85 ± 4
7	10.0	82 ± 4	84 ± 4	85 ± 4	86 ± 5	89 ± 5