PHOTOLUMINESCENT EFFECT IN COMPOSITES PP + 0.5% MnO_2 and PP + 1% MnO_2

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There has been investigated the influence of electrothermopolarization on the photoluminescence spectrum of compositions on PP-based with MnO_2 λ=250-1000nm. It is established that low-molecular additions within wavelength photoluminescence spectra due to volume content of addition and conditions of electrothermopolarization vary strongly. Observed changes of spectra for compositions depending on MnO_2 concentration are related to the change of supramolecular structure of polymers, conditions of electrothermopolarization with the change of interaction degree between polymer phases with the filler at the expense of charges accumulated at the phase boundary.

Keywords: composite, photoluminescent, polypropylene, electrothermopolarization.
PACS: 77.55

INTRODUCTION

Recently, a lot of work has been done on the study of polymer nanocomposites with photoluminescent properties. It is known that in composite systems, consisting of polymer-polymer low-molecular additions, are divided into two parts: the formation of the physico-chemical structure of the transitional layer and the formation of the interlayer. In two-phase systems, interfacial interactions depend mainly on the structure of the interphase layer between the components of the composite. In biphasic compositions, the change in phase interaction leads to the change in photoluminescent properties [1-2]. In polymer-based composites, the physical structure changes as a result of electrothermopolarization, which, in turn, changes the interfacial interactions between the components of the composite. The accumulation of charges at the interphase layer between the components of the composite can enhance interfacial interactions, which in turn will lead to a change in the photoluminescent properties of the composite [3-5].

The state of the art in the field of obtaining and studying photoluminescence in polymers and compositions based on them is analyzed. Determined that photoluminescent properties of polymer-based composites depend on the chemical and physical nature of the polymer matrix (electronegativity, polarity, supramolecular structure), properties filler, processes of intermolecular transfer and migration of electronic excitation energy.

OBJECTS AND METHODS OF EXPERIMENT

In this work, photoluminescent properties of composites on the basis of PP, filled with additions of MnO_2, were studied in the field of wavelength λ = 250-1000 nm. Photoluminescent properties were obtained with the help of Cary Eclipse spectrofluorimetry. The samples were obtained by hot pressing of the polymer after melting at a temperature of 15 MPa for 3 minutes and subsequent cooling under pressure to room temperature. The obtained samples were subjected to electrothermal polarization t_n = 1 hour at the time of 1 hour at a temperature of T_p = 353K. The voltage of the electric field applied to the layer was 10^7 V/m.

RESULTS AND THEIR DISCUSSION

It is known that in molecules with photoluminescent activity, intermolecular interactions essentially affect their spectral characteristics. It has been established that the change in the spectra of photoluminescence occurs with an increase in the concentration of non-processed, as well as in electrothermopolarized compositions of PP + MnO_2. It is shown that the peak of photoluminescence in the visible area depends on the concentration of the filler. On Figure 1 shows the PL spectra of a composite based on PP + 0.5% MnO_2 obtained at 280 nm. As can be seen, before electrothermopolarization, 4 maxima wereobserved at 328; 358; 381.07; 418.93 nm (Fig. 1a). The same 4 peaks wereobserved at wavelengths of 329.07; 358; 381.07; 420nm after electrothermopolarization (Figure 1.b). A relatively sharp peak was observed at 381.07 nm. The peak intensity after electrothermopolarization (λ = 381.07nm) was greater than the peak intensity obtained for the non-processed (E = 0) sample. The spectra of composites before and after the electrothermopolarization are almost identical. The location of the peaks relative to each other (381.07nm and 420nm) and the width of the peaks relative to the half-height are almost identical too. Thus, after electrothermopolarization in the giwen composite, the polymer was uniformly distributed in the matrix and ensured the long-term stability of its characteristics.

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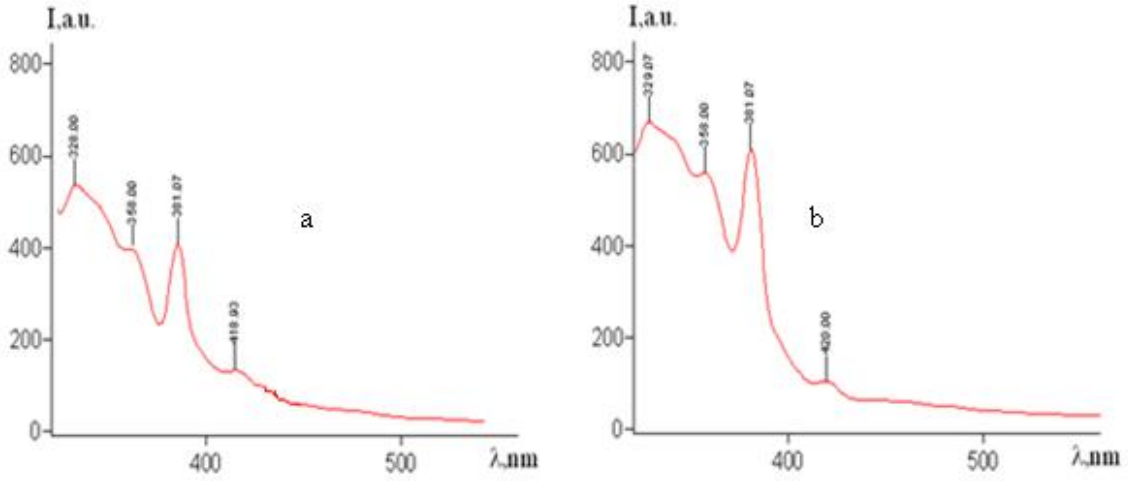

Fig.1. Photoluminescent peaks of the composition on the basic of PP + 0.5% MnO_2 before (a) and after (b) electrothermopolarization.

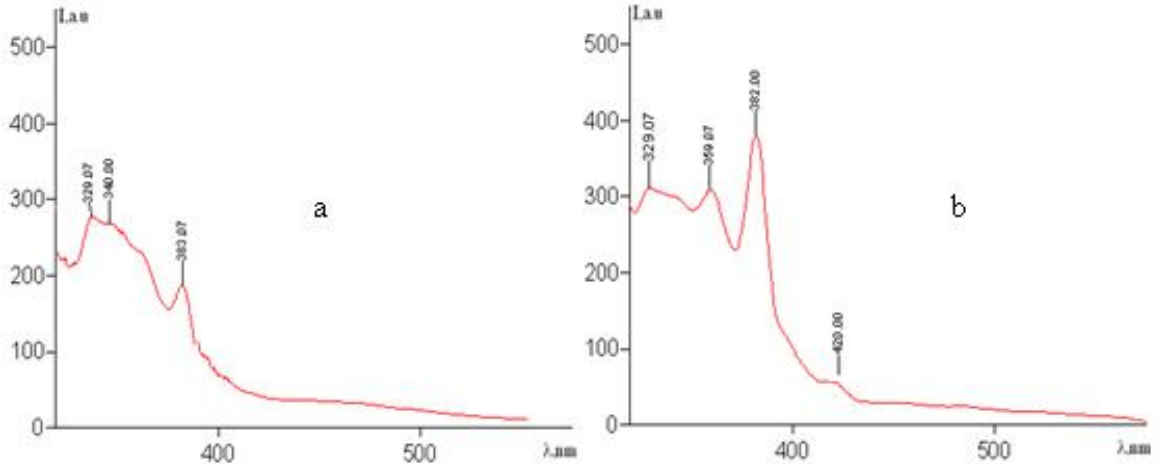

Fig.2. Photoluminescent peaks of the composition on the basic of PP + 1% MnO_2 before (a) and after (b) Electrothermopolarization.

Figure 2 presents the spectra of photoluminescence of the composite PP + 1% MnO_2 at a wavelength of 280 nm. Before electrothermopolarization in the PL spectrum composite PP+1% MnO_2 (Figure 2.a) 3 maximum wereobserved at the following wavelengths: 329.07nm; 340nm; 383.07nm; and after electrothermopolarization 4 peaks (Figure 2.b): 329.07 nm; 359.07 nm; 382 nm; 420 nm. After electrothermopolarization, the amplitude of the maxima over the entire length of the wave has increased. The highest intensity peak was observed at the wavelength of 382 nm.

The intensity of the peak increased after electrothermopolarization. At E = 0, the intensity of the spectrum of the composite PP + 1% MnO_2 sharply decreases. The interfacial interaction of electrothermopolarization changes, new luminescence centers are activated in the MnO_2 filler, which leads to an increase in the photoluminescence amplitude.

Thus, it has been established that the photoluminescence spectrum differs sharply depending on the content volume of the filler and the conditions of electrothermpolarization. The change in the spectrum of the composite depending on the concentration of MnO_2 is associated with a change in the supramolecular structure of the polymer, since, depending on the conditions of electrothermopolarization, charges accumulate at the interface between the polymer phase and the filler.

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PP + 0,5% MnO_2 və PP + 1% MnO_2 KOMPOZİTLƏRDƏ FOTOLÜMİNESENT EFFEKTİ

PP əsaslı MnO_2 kompozitlərin λ=250-1000nm olan fotolüminessensiya spektrinə elektrotermopolyarlaşmanın təsiri tədqiq edilmişdir. Müəyyən edilmişdir ki, fotolümisent spektri doldurucunun həcmi miqdarından və elektrotempolyarlaşma şəraitindən aslı olaraq kəskin fərqlənir. MnO_2-nin konsentrasiyasından aslı olaraq kompozitin spektrində müşahidə olunan dəyişiklik, elektrotermopolyarlaşma şəraitindən aslı olaraq polimer faza ilə doldurucunun sərhəddinə yığılan yüklərlə və polimerin üstmolekulyar quruluşunun dəyişməsi ilə bağlıdır.