THE CHANGE OF THERMAL PROPERTIES OF COMPOSITE MATERIALS ON THE BASE OF POLYMERS AND MAGNETIC ADDITION UNDER MAGNETIC FIELD INFLUENCE

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The investigation results on influence of crystallization temperature-time regime and magnetic field influence on composite thermal properties on the base of polymers (PEVP, PVDF) and magnetic addition $BaO(Fe_2O_3)_6$ are given in the given work. It is shown that change of thermal properties of investigated magnetic compositions in the dependence on crystallization temperature-time regime and processing in strong constant magnetic field can be connected with change of permolecular structure of polymer matrix, degree of interference between phases and thickness of near-boundary layer. It is also established that magnetic field influence on PEVP+$BaO(Fe_2O_3)_6$ samples obtained in the regime of nitrogen hardening leads to improvement of thermal properties of composite materials: thermal resistance increases, total mass loss decreases.

The devices with elements from polymer-ferromagnetic compositions are treated by continuous influence of constant and alternative magnetic field at their exploitation. The processing of magnetic polymer compositions at constant and alternative fields, and also the change of crystallization temperature-time regime can change their thermal properties [1].

The influence of crystallization regime and magnetic field on composition thermal properties polymer (PEVP, PVDF) – baric hexaferrite ($BaO(Fe_2O_3)_6$) have been investigated. The composition thermal properties have been investigated by differential-thermal method (DTA), differential-thermal-gravimetric method (DTG) and thermal-gravimetric method (TG) on Q- derivatograph by MOM firm (Hungary) in temperature interval 20-540°C. Al_2O_3 burnt at 1000°C is used in the capacity of temperature standard. The sensitivity on canals is: DAT is 1/5; DTG is 1/15; TG is mg 200 [2].

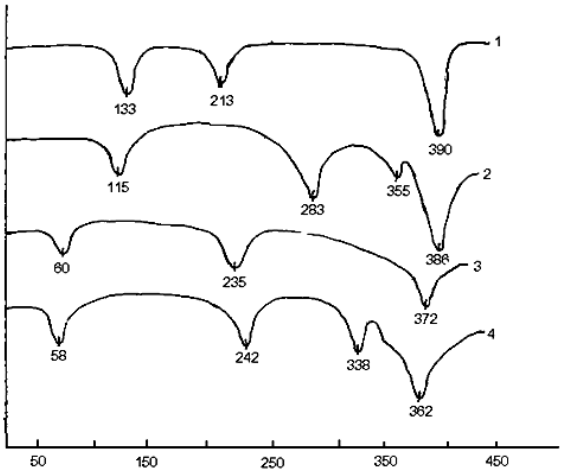

Fig.1. DTA of mix curves of PEVP-$BaO(Fe_2O_3)_6$ system samples, obtained by crystallization in NH regime:
1 - PEVP (initial);
2 - 90vol%PEVP+10vol% $BaO(Fe_2O_3)_6$;
3 - PEVP (after processing);
4 - 90vol%PEVP+10vol% $BaO(Fe_2O_3)_6$ (after processing).

The initial polymers PEVP and PVDF (without addition) and polymer-magnetic composite materials on the base of PEVP, PVDF and magnetic additions $BaO(Fe_2O_3)_6$ are obtained by hot pressing method under the pressure 15MPa at polymer matrix melting point during 10 minutes with further cooling in the following crystallization regimes: 1 – the samples are put in the vessel with liquid nitrogen (nitrogen hardening (NH)); 2 – the samples are cooled in the mixture of ice with water with rate 2000degree/min (fast cooling regime (FC)); 3 – melt slow cooling up to room temperature with rate 2 degree/min (SC).

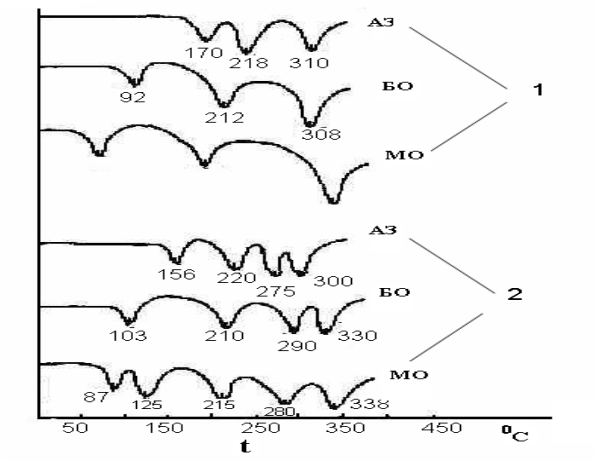

Fig.2. DTA curves in the dependence on crystallization regime:
1 – PVDF (initial);
2 – 90vol.%PVDF + 10vol.%$BaO(Fe_2O_3)_6$.

DTA curves of PEVP without addition and with magnetic addition $BaO(Fe_2O_3)_6$ obtained in NH regime before and after magnetic field influence are given on fig.1. From the figure it is seen that endothermal effects (fig.1, curve 1) at 133°C, 213°C and 390°C are observed on DTA PEVP curves. The endoeffect at 133°C corresponds to melting of polymer matrix crystalline part PEVP. The endoeffect at 213°C corresponds to weak bond opening and endoeffect at 390°C corresponds to PEVP depolymerization. The endoeffect temperature at 133°C shifts to the side of low

temperatures and becomes equal to 125°C at addition into PEVP+10vol% $BaO(Fe_2O_3)_6$ (fig.1, curve 2) and it corresponds to melting of composition 90vol% PEVP+10vol% $BaO(Fe_2O_3)_6$. The temperature of weak bond opening corresponds to 283°C.

From above mentioned it is followed that change in thermal effect temperatures evidence about formation of new interfacial phase on interface between composite components.

At influence of magnetic field on PEVP and 90vol% PEVP +10vol% $BaO(Fe_2O_3)_6$ composite it is established that temperature of weak bond opening shifts to the side of high temperatures, and depolymerization temperature shifts to the side of low ones.

The analogous investigations have been carried out for initial polymer PVDF and PVDF+ $BaO(Fe_2O_3)_6$ composite.

The relative high melting point of PVDF crystalline part (170°C) and high temperature of weak bond opening (218°C) in the comparison with samples obtained in FC and SC regimes is observed at fast crystallization in NH regime in PVDF films (fig.2, curve 1). However, the samples of 90vol% PVDF+10vol% $BaO(Fe_2O_3)_6$ composition obtained in SC regime (fig.2, curve 2) are more thermostable ones in the comparison with NH, FC.

Thus, in the result of investigations it is established that the change of thermal properties of investigated magnetic compositions on PEVP + $BaO(Fe_2O_3)_6$ and PVDF + $BaO(Fe_2O_3)_6$ in the dependence on temperature-time crystallization regime and processing in strong constant magnetic field can be connected with change of permolecular structure of polymer matrix, degree of interference between phases and thickness of near-boundary layer. It is also shown that magnetic field influence on PEVP + $BaO(Fe_2O_3)_6$ samples obtained in NH regime leads to the improvement of thermal properties of composite materials: thermal resistance increases, total mass loss decreases.

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POLİMERLƏR VƏ MAQNİT ƏLAVƏSİ ƏSASINDA ALINMIŞ KOMPOZİT MATERİALLARIN MAQNİT SAHƏSİNİN TƏSİRİ ALTINDA TERMİK XASSƏLƏRİNİN DƏYİŞMƏSİ

İşdə kristallaşmanın temperatur-zaman rejiminin və sabit maqnit sahəsinin polimerlər (YSPE, PVDF) və maqnit əlavəsi $BaO(Fe_2O_3)_6$ əsasında alınmış kompozitlərin termik xassələrinə təsiri öyrənilmişdir. Göstərilmişdir ki, tədqiq olunan maqnit kompozitlərinin termik xassələrinin kristallaşmanın temperatur-zaman rejimindən və güclü sabit maqnit sahəsində işlənməsindən asılı olaraq dəyişmələri polimer matrissanın üstmolekulyar quruluşunun, fazalararası qarşılıqlı təsirin və sərhəd yanı təbəqənin qalınlığının dəyişmələri ilə əlaqədardır. Müəyyən edilmişdir ki, azot bərkiməsi (AB) rejimində alınmış YSPE + $BaO(Fe_2O_3)_6$ nümunələrinə maqnit sahəsinin təsiri onların termiki xassələrini yaxşılaşdırır, belə ki, termik davamlılıq artır, ümumi kütlə itkisi azalır.

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ИЗМЕНЕНИЕ ТЕРМИЧЕСКИХ СВОЙСТВ КОМПОЗИТНЫХ МАТЕРИАЛОВ НА ОСНОВЕ ПОЛИМЕРОВ И МАГНИТНОЙ ДОБАВКИ ПОД ДЕЙСТВИЕМ МАГНИТНОГО ПОЛЯ

В работе изложены результаты исследований по влиянию температурно-временного режима кристаллизации и действия магнитного поля на термические свойства композитов на основе полимеров (ПЭВП, ПВДФ) и магнитной добавки $BaO(Fe_2O_3)_6$. Показано, что изменение термических свойств исследуемых магнитных композиций в зависимости от температурно-временного режима кристаллизации и обработки в сильном постоянном магнитном поле можно связать с изменением надмолекулярной структуры полимерной матрицы, степени взаимодействия между фазами и толщины приграничного слоя. Установлено также, что воздействие магнитного поля на образцы ПЭВП+ $BaO(Fe_2O_3)_6$, полученные в режиме азотной закалки, приводит к улучшению термических свойств композитных материалов: увеличивается термостойкость, уменьшается суммарная потеря массы.

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