THE OBTAINING AND STUDYING OF ELECTRET PROPERTIES OF *PELD+x vol.%* $TlGaTe_2(TlInSe_2)$ COMPOSITIONS

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The obtaining technology, investigation technique of polyethylene of low density with the additions of semiconductor compounds $TlInSe_2$, $TlGaTe_2$ are processed in the presented work and the investigation results of electric properties of these composition materials are described.

The wide distribution of polymer materials, conquered the positions in all regions of human activity is the one of the character elements of technical advancement. It is well known, that the most essential advantages of this type of materials, to which the small specific gravity, the ability to transform into complex configurations products with the help of high-production and accessible methods, the infusion possibility of complex valued technical properties to them, and also the presence of wide source of raw materials are related to.

The good agreement of physicomechanical and electric properties of polymer materials allows to more widely use them in the capacity of electric isolation and dielectrics in cable manufacture, and also in the manufacture of electric machines, apparatuses and compensators. It is necessary the deep studying of polymer electric properties in the dependence from their construction and exploitation conditions for rational polymer application.

Note, that polymers with different additions are studied well enough, however, information about influence of additions of inorganic nature on electric properties of these materials is very scanty. The influence of additions of semiconductor origin on polymer properties isn't considered at all. There is some information of foreign [1-3] and domestic investigators [4,5]. The information about obtaining of polyethylene polymer compositions (PELD) of low density with addition of semiconductor compound $TlInSe_2$ is recently appeared. It is revealed, that it is possible to increase the life time of electret materials from PELD on 4.5÷6 times with the help of additions $TlInSe_2$.

From above mentioned, the obtaining technology of composition material PELD with $TlGaTe_2$ and $TlInSe_2$ additions, the investigation technique of electret materials and some electrophysic properties of these composition materials are described in the present work.

The samples for the investigation are obtained by the following method: polymer powder is mixed with $TlGaTe_2$ ($TlInSe_2$) powder. Further, the films 100 mcm at melting point of polymer matrix and pressure 10÷15 MPa between aluminum foil are pressed from the mixture. The samples, obtained by such methods, are suitable for studying of electret properties.

Note that coronoelectrets are obtained in the fields of less intensity. The cusped electrodes, being on some distance from the surface of charged dielectric are applied for this. The corona discharge takes place between nib and surface, correspondingly air ionization and displacement of charge carriers, which are electrons and ions, to electret surface. The charge carriers stay mainly in dielectric near-surface layer. The field intensity in polymer at this is low one that is lower then polymer puncture strength. The charge values are limited by puncture strength of environment. The charging speed can be big enough and the charges are equally distributed on the surface.

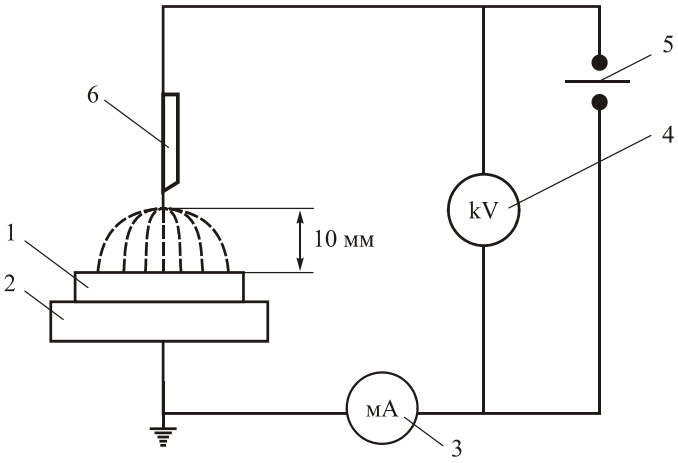

Fig.1. The installation for electret obtaining in corona discharge.

The installation scheme for electret obtaining in the corona discharge is presented on the fig.1. The polymer film 1 is put on the low grounded electrode 2 under the nib needle-electrode 6, being on the distance 10 mm under the film surface. The upper needle-electrode is connected to high-voltage edge of power supply 5. The needle potential is defined with the help of kilovoltmeter 4, and also efflux at corona discharge with the help of milliammeter. The film polarization is carried out at constant voltage6 kV during 5 min.

Further the voltage injection is stopped. Later the polarized sample is put into cell, where the surface potential is defined by contact-free induction method. The installation scheme for the measurement of surface density of electret charges with periodical screening of measuring electrode is given on the fig.2. The device consists of massive metallic cylindrical body, on which the electromotor 1 is fixed. The one impeller 2, having four arms is fixed on the electromotor shaft. The impeller is between the low ground electrode, and upper measurement one, on which the sample is fixed. The screening of upper measurement electrode from the field, formed by electret takes at impelling rotation, that it is equivalent to the appearance of variable signal in the chain, which has the concatenation with oscillograph 4 electrodes. The compensating voltage is injected from the source of

constant voltage 3, supplied by slow voltage regulator and is registered by oscillograph. The sign of charge surface densities is defined on the sign of compensating voltage, injected by voltmeter.

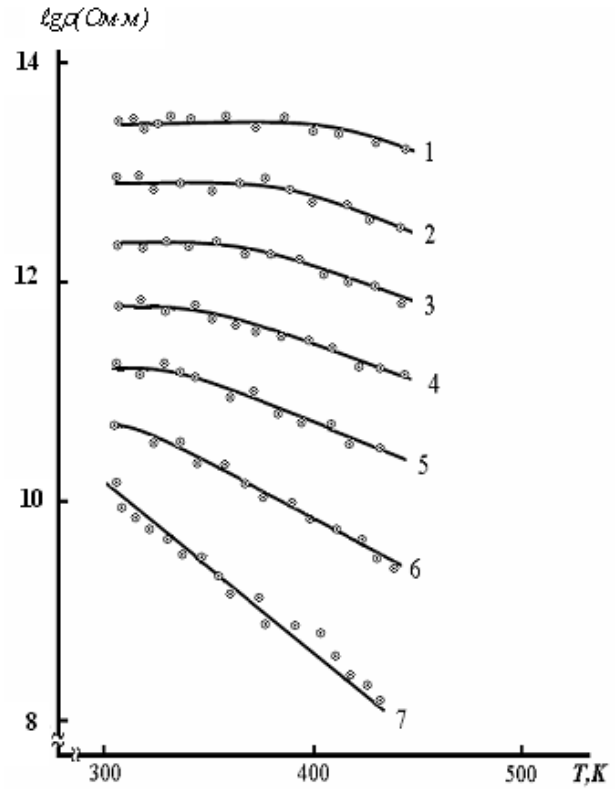

Fig.2. The temperature dependence of specific resistance for compositions PELD+X vol.% $TlInSe_2$, where 1-*x=0*; 2-*x=3*; 3-*x=5*; 4-*x=10*; 5-*x=20*; 6-*x=30*; 7-*x=40*.

The surface density of electret charge is measured by induction method with compensation and is defined on the formula:

$$\sigma_{eff} = \frac{\varepsilon\varepsilon_0 U_к}{d}$$

where σ_{eff} is charge surface density (Kl/m^2), ε is sample permittivity, ε_0=8.85·10^{-12}F/m is electric constant, U_k is compensating voltage (*V*), *d* is electret sample thickness (*m*).

We define the life time on the formula

$$\tau = \frac{t_{xp1} - t_{xp2}}{ln\sigma_2 - ln\sigma_1}$$

by the working of experimental results $\sigma_{eff}=f(t_{xp})$, where σ_1 and σ_2 are charge surface densities, corresponding to retention times t_{xp1} and t_{xp2}, correspondingly.

In the given work we investigate the temperature dependence of specific resistance of compositions PELD+x vol.% $TlInSe_2$. The investigations are carried out in the temperature interval 300-450K.

As it is followed from the figure 2, the resistance decrease with temperature increase is character for all compositions. This, probably, is connected with storage of PELD structure. However, the decrease amplification of specific resistance in the dependence on the composition is observed with increase of $TlInSe_2$ content in composition compounds. The relatively essential and linear dependencies in the whole investigated temperature interval are observed for the composition PELD+40vol.% $TlInSe_2$.

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ASPE+x həcm% $TlGaTe_2$($TlInSe_2$) KOMPOZİSİYALARININ ALINMASI VƏ ELEKTRET XASSƏLƏRİNİN ÖYRƏNİLMƏSİ

Təqdim olunan işdə $TlGaTe_2$ və $TlInSe_2$ əlavəli aşağı sıxlıqlı polietilenin alınma texnologiyası işlənilmiş, elektrik xassələrinin ölçülməsi üçün metodika seçilmiş və elektrik xassələri öyrənilmişdir.

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ПОЛУЧЕНИЕ И ИЗУЧЕНИЕ ЭЛЕКТРЕТНЫХ СВОЙСТВ КОМПОЗИЦИЙ ПЭНП+x об.% $TlGaTe_2$($TlInSe_2$)

В представленной работе разработана технология получения, методика исследования полиэтилена низкой плотности с добавками полупроводниковых соединений $TlInSe_2$, $TlGaTe_2$ и изложены результаты исследования электрических свойств этих композиционных материалов.

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