

# INFLUENCE OF PRELIMINARY ELECTRO TREATMENT TO THE STRENGTH AND THERMAL PROPERTIES OF COMPOSITIONS ON THE BASIS OF POLYETHYLENE AND PIEZOCERAMICS

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## ABSTRACT

Are investigated an influence of preliminary electro treatment in the electric field to the strength (mechanical strength  $\sigma$ , electrical strength  $E$ ) and thermal (initial temperature and activation energy of thermal destruction) properties of compositions on the basis of polyethylene and piezoceramics PCR5 and PCR8. It was determined a correlation between the change of the strength and thermal properties of researched compositions after their electro treatment in the electric field

**Keywords:** influence, temperature, compositions, electric field, polyethylene.

## I. INTRODUCTION

The strength and thermal properties of compositions on the basis of polyethylene and piezoceramics are the main in various gauges and device with elements of these composition [1-4]. In the given article are shown the research results of influence preliminary electro treatment on the strength and thermal properties of compositions on the basis of polyethylene and piezoceramics PCR5 and PCR8. The warm pressing of mechanical mixture from polymer powder polyethylene and piezoceramics of PCR5 and PCR8 of type in fusions temperature of polymeric matrix under pressure 15MPa prepare the compositions separately during 10 minutes with following cooling. Components ration were 70vol%PE+30vol%PCR5 and 70vol%PE+30vol%PCR8.

Mechanical and electrical strength are measured in 293K temperatures by the methods, described in articles [5,6] and the thermal characteristics were determined by methods differential thermal analysis and thermo gravimetric methods.

On the table are shown the mechanical strength  $\sigma$ , electrical strength  $E$ , initial temperature  $T^{\circ}K$  and activation energy values of thermal destruction  $D$  process of investigated compositions on the basis of polyethylene and piezoceramics PCR5 and PCR8 before and after treatment.

## II. MAIN PART

From table we can see, that in case of 70vol%PE+30vol%PCR5 compositions after electro treatment we observe of mechanical and electrical strength, initial temperature and activation energy in thermal destruction process increase, by theirs decrease in 70vol%PE+30vol%PCR8 compositions.

Table 1

Contents of compositions	70vol%PE + 30vol%PCR5	70vol%PE+ 30vol%PCR8
Insensitivity of electrical field $E_{ep}=10^6V/m$	0 10	0 10
Mechanical strength, $\sigma$ MPa	7 9	9 6
Electrical strength $E$ , $10^6V/m$	16 32	20 12
Initial temperature of termodestruction $T^{\circ}K$	393 413	473 423
Activation energy of termodestruction $D$ , J/mol	113 116	131 107

Also we have to note, that in article [8] is shown the increase till  $E=(10-11) \cdot 10^6V/m$ , and then decrease mechanical and electrical strength depending from electro treatment intensity in case of 70vol%PE+30vol%PCR5 compositions, but in 70vol%PE+30vol%PCR8 compositions case strength is only decreased depending from  $E_p$ . The observed differences in strength and thermal properties changes after the electro treatment of compositions 70vol%PE+30vol%PCR5 and 70vol%PE+30vol%PCR8 connect with piezoceramics structure PCR5 and PCR8. It is known that piezoceramics PCR5 have rhombohedral and PCR8 have tetragonal

structure. Because the PCR5 piezoceramic in comparison with PCR8 piezoceramics has more by size reorientated polarization and electro negativity that increases the polymer matrix and piezoceramics adhesion is observed the increases the polymer of their strength and thermal properties after electro treatment in comparison with PCR8 compositions, where these properties are decreased.

### III. CONCLUSION

Thereby is determined correlation between the changes of strength and thermal properties of investigated compositions after their electro treatment. The observed correlation is explained, that the more compositions strength the higher, a temperature for thermal destruction process beginning and the more and activation energy for this process.

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