DIELECTRIC PREPERTIES AND PECULIARITIES OF RADIOTHERMOLUMI NESCENCE OF COMPOSITIONS POLYPROPYLENE -METAL OXIDES

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ABSTRACT

The given work presents the experimental data on study of temperature dependences ε (T) and angle tangent of dielectric losses tgδ (T) of polypropylene (PP) and composites on the basis of beryllium oxide BeO at different components ratios as well as investigation of radiothermoluminessence (RTL) in these systems. Comparing the results on temperature dependencies of dielectric permittivity ε, angle tangent of dielectric lasses tgδ and RTL spectra of the studied compositions one can say that observed low –temperature maximum in temperature dependence of electro physical parameters (ε and tgδ) of composites is the result of change of polymer matrix macromolecules molecular mobility and its effect on interfacial interaction with filler.

The electro active polymeric films and compositions on their basis are used as sensitive elements, dosimeters, sensors in many branches of industry, sensor electronics, ecology, etc.[1] Therefore, the study of their electroactive dielectric, sensor properties as well as establishment of interrelation of these properties with structural peculiarities, preparation technology, filling techniques, polarization the methods are the urgent.[2] It should be noted that many properties of composite materials are determined by interfacial interaction in polymer – filler system and its mechanism understanding will allow modification or prediction of their operating characteristic.[3]

The present work object was the determination of interrelation between the dielectric properties and interfacial interaction polymer –filler.

1. INTRODUCTION

The given work presents the experimental data on study of temperature dependences ε (T) and angle tangent of dielectric losses tgδ (T) of polypropylene (PP) and composites on the basis of beryllium oxide BeO at different components ratioes as well as investigation of radiothermoluminessence (RTL) in these systems. The composite samples were obtained by thermo pressing from premixed powders of polymer –PP and filler (BeO). The dielectric measurements were carried out by standard procedure and RTL spectra were taken in thermoluminograph RTL -69 on FEU -51 base RTL excitation was performed by action of 10 kGr dose y- quanta from Co^{60} source on samples preenacuated at 10^{-2} atm in ampules.

2. RESULTS AND CONCLUSIONS

As is seen from temperature dependences of dielectric permittivity ε and angle tangent of dielectric losses tgδ (Fig.1), the maxima in composite samples are observed in temperature region 320-325 K (curves 2, 3, 4).

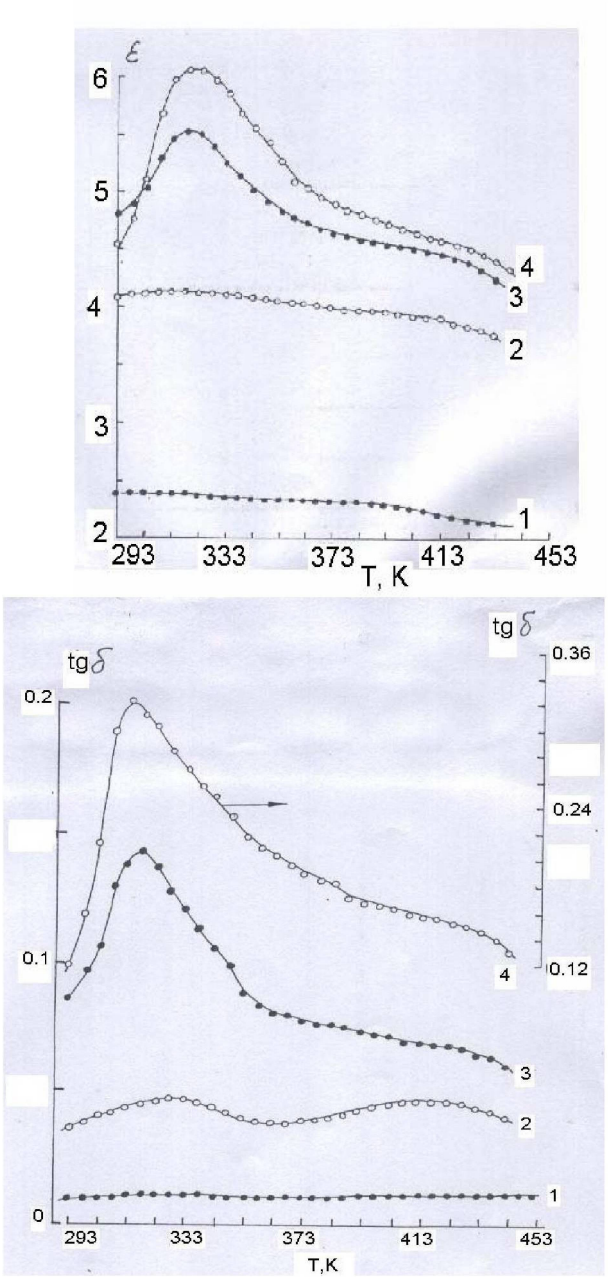


Fig. 1. Temperature dependences of ε(T) and tgδ (T) of polypropylene and composites polypropylene / BeO: 1-PP; 2-PP/3% BeO; 3- PP/ 5%; 4-PP/10% BeO

It is seen from these dependences that ε and tgδ of pure PP either don't nearly change or decrease slightly (ε) the analysis of the same materials (Fig.2) radiothermoluminessence (RTL) spectra showed that RTL spectra of pure PP had three maxima at temperatures 146 K, 193 K and 267 K (curve 1). The comparison of polymer and composite (curves 2, 3, 4) spectra shows that beryllium oxide introduction into polymer leads to maxima shift towards high temperature for the first (146 K) and second (193K) peaks and towards low temperatures for the third (267 K) peak, in this case the third peak intensity was strongly suppressed. Based upon this, one can say that filler introduction into polymer leads to the change of polymer matrix kinetic units mobility.

The maximum shift towards low temperatures is a result of activation energy decrease. In glass- transition in polymer matrix should be reflected in increasing of macromolecules segment mobility.

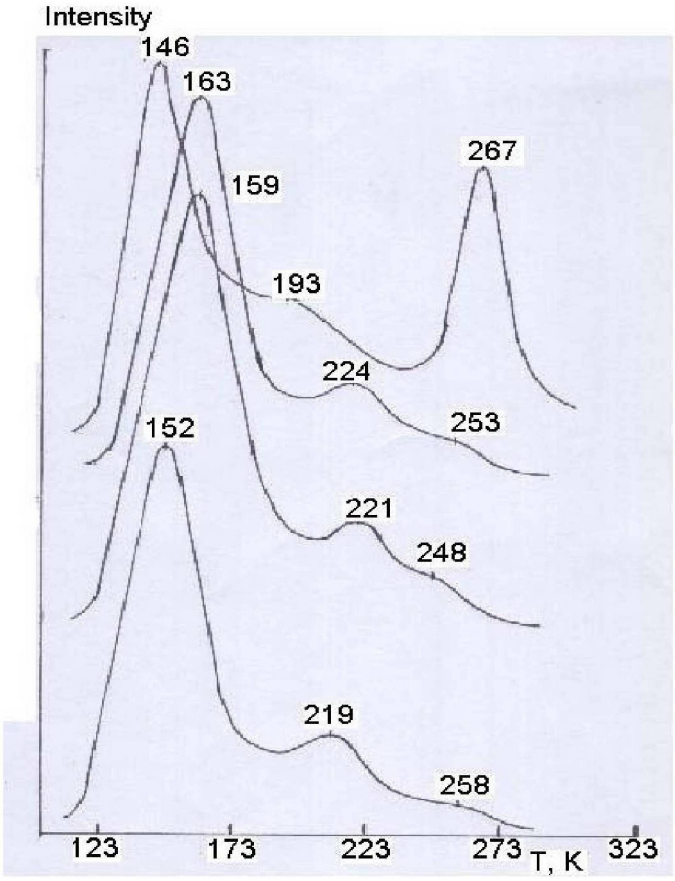


Fig. 2. RTL spectra of polypropylene and composite polypropylene /BeO: 1-PP; 2-PP/3% BeO; 3- PP/ 5%; 4-PP/10% BeO

The experimentally observed suppression of β-process (III peak in RTL spectra) in composite is rather the result of matrix structure amorphizm after filler introduction , i.e. by decrease of polymer matrix crystallinity The mobility increase occurs in remoted it filler surface sites where matrix crystallinity still remains and in interfacial layer at interface of matrix with filler mobility decreases rather due to filler surface activity.

These changes, in their turn , lead to the appearance in matrix volume of new catch sites, which are reflected in maximum orating in temperature dependences of ε and tg δ.

Comparing the results on temperature dependencies of dielectric permittivity ε, angle tangent of dielectric lasses tgδ and RTL spectra of the studied compositions one can say that observed low–temperature maximum in temperature dependence of electro physical parameters (ε and tgδ) of composites is the result of change of polymer matrix macromolecules molecular mobility and its effect on interfacial interaction with filler.

3. REFERENCES

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