Influence of electric field on the thermal properties of PP+NC nanocomposites for environmental chemistry application

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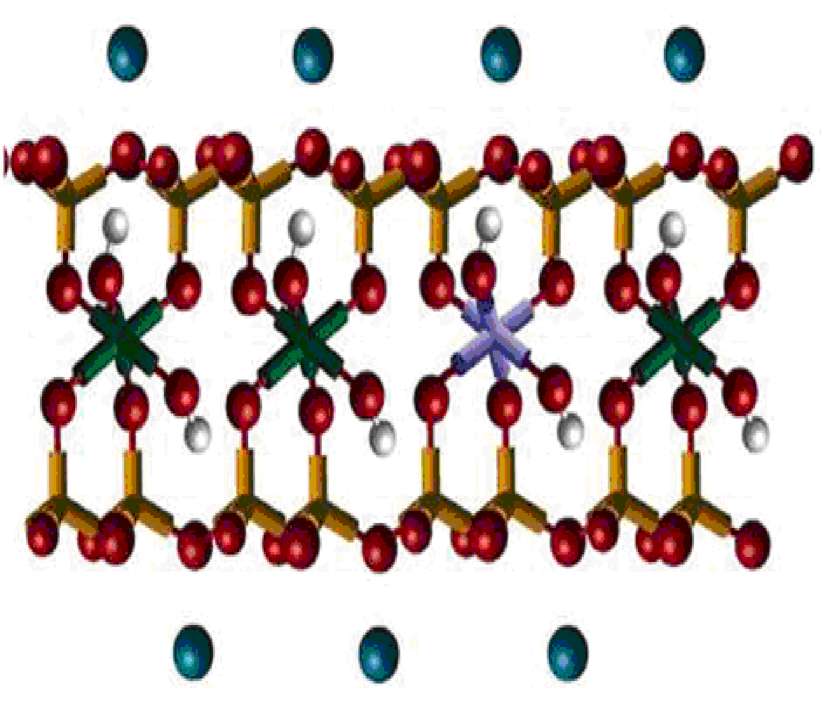
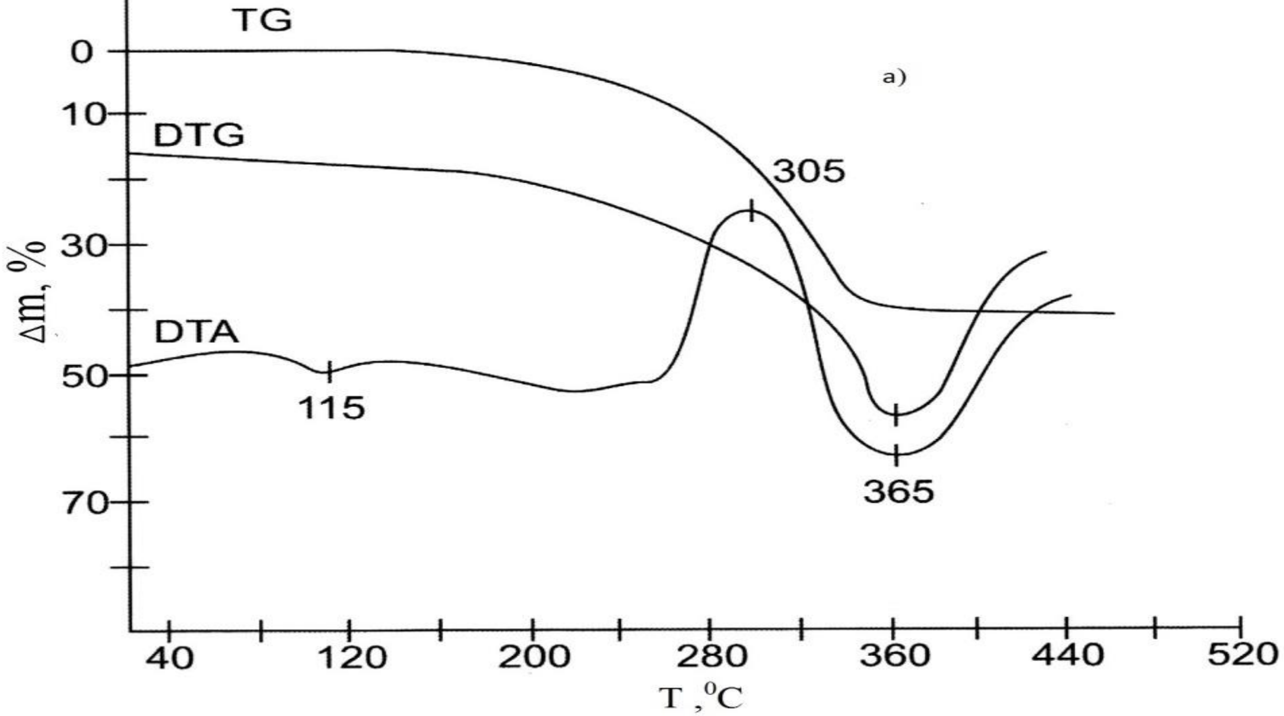
İnvestigation Method

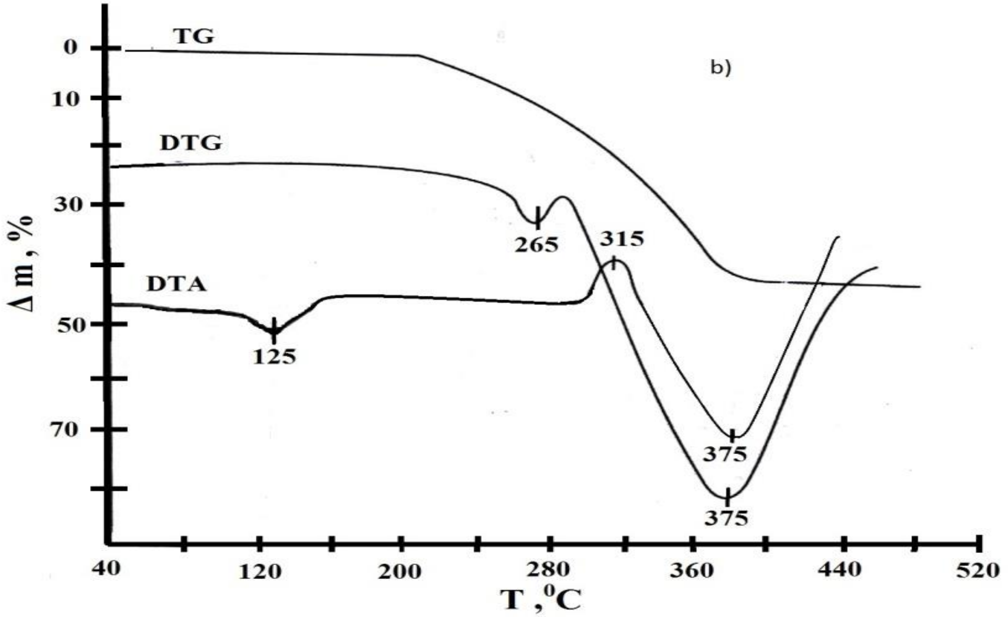
Using Differential Thermal Analysis (DTA) method the thermal-physical properties of nanocomposites Polipropylene +Nanoclay were studied and the thermal-destruction processes after aging in an electric field were determined.

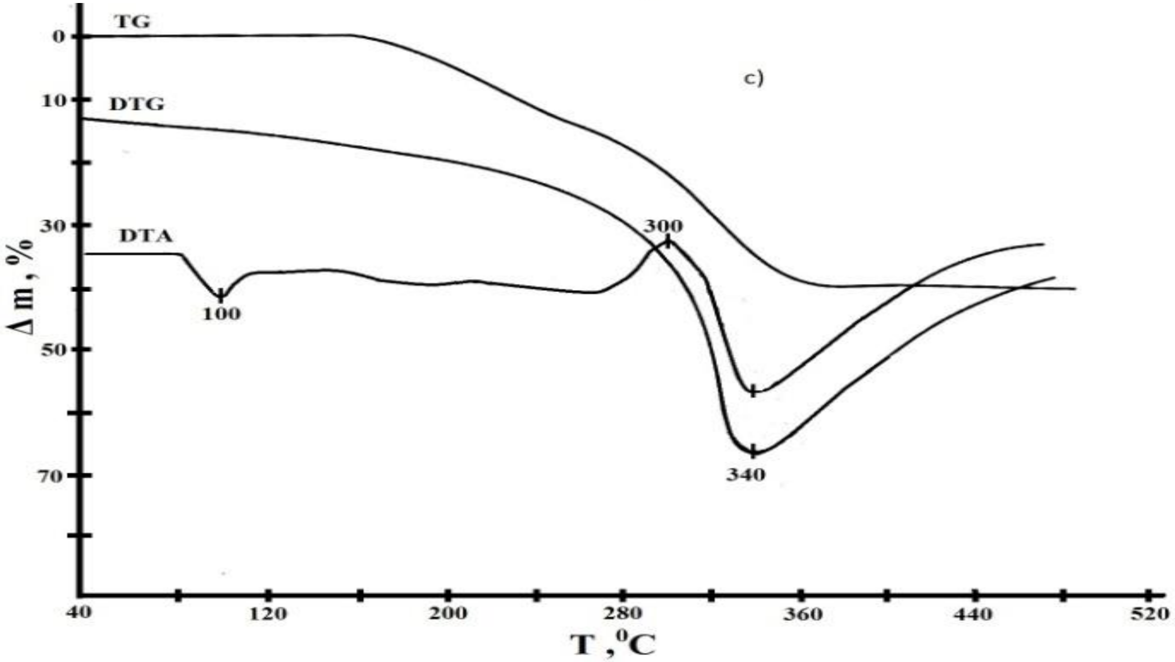


Atomic structure of NC

Nanoclay (NC) used as an additive is montmorillonite (MMT) layered silicate and the dimensions of these layers are: length up to 200 nm, width in the range of 1-3 nm . Al, Mg, and Fe atoms are located in the center of the MMT crystal and are covered with a SiO_2 layer on the outside.







Thermal spectrums of pure PP and nanocomposites:

a) pure PP; b) PP+2,0% NC;

c) PP+10,0% NC

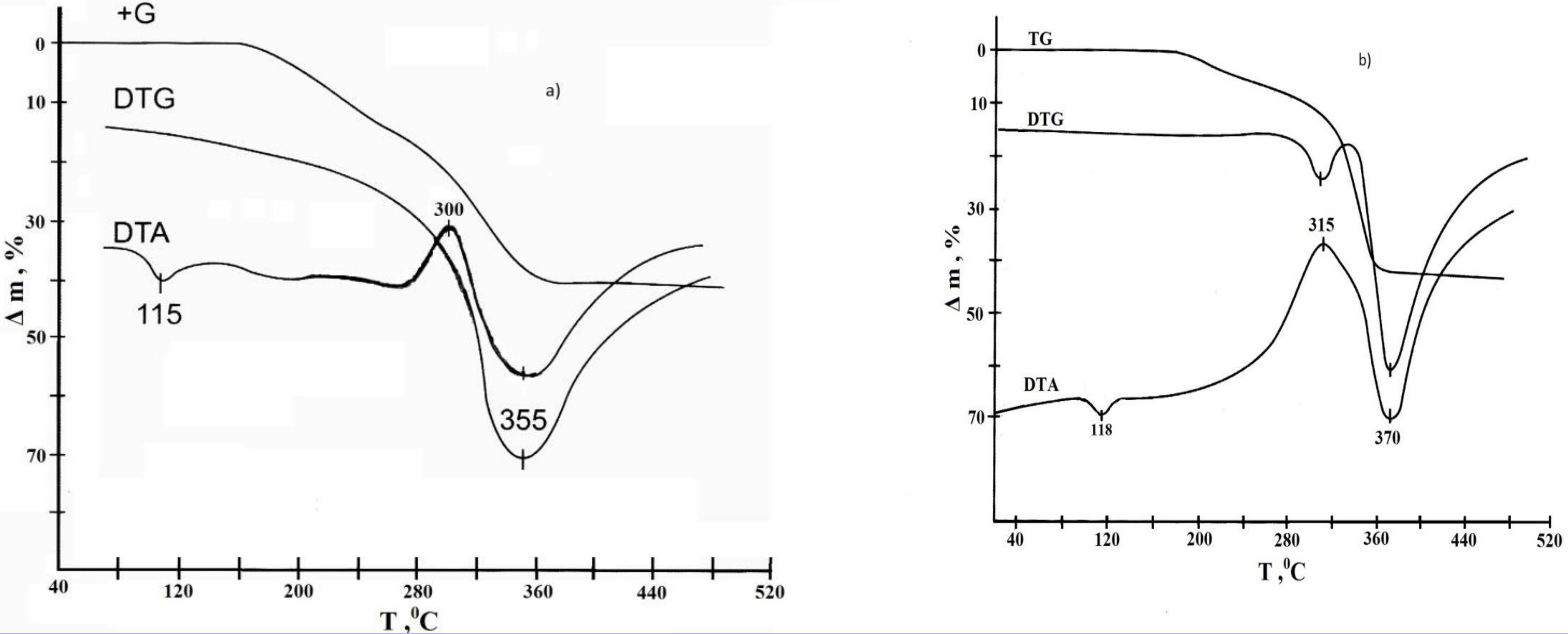


Fig.2. Thermal spectrums of pure PP and nanocomposite after the influence of electric field (t=60 hours): a) pure PP; b) PP+2,0% NC;

Table. The results of experiment.

Samples	DTA		DTQ	TQ
	Endothermic effect, T^0C	Exothermic effect, T^0C	Endotermic effect, T^0C	Δm, %
Pure PP	$T_{melt.}=115$ $T_{depol.}=365$	$T_{ter.oxy.}=305$	T=365	54
PP+2,0% NC	$T_{melt.}=125$ $T_{depol.}=375$	$T_{ter.oxy.}=315$	T=375	62
PP+10,0% NC	$T_{melt.}=100$ $T_{depol.}=340$	$T_{ter.oxy.}=300$	T=340	50
$E=2\cdot10^7$V/m, t=60 hours				
Pure PP	$T_{melt.}=115$ $T_{depol.}=355$	$T_{ter.oxy.}=300$	T=355	50
PP+2,0% NC	$T_{melt.}=118$ $T_{depol.}=370$	$T_{ter.oxy.}=315$	T=370	59

Conclusion

1. The melting temperature of the crystalline phase of the pure PP matrix $T_{melt}.=115\ ^0C$ (endothermic effect); depolymerization temperature $T_{depol}.=365\ ^0C$; exothermic effect during thermooxidation $T_{ter.oxi}.=305\ ^0C$; and the residual mass is $\Delta m=54\%$.
2. In the amount of 2.0% volume of NC, these indicators increase relatively: $T_{melt}.=125^0C$; $T_{depol.}=375\ ^0C$; $T_{ter.oxi.}.=315^0C$; $\Delta m=62\%$.
3. At a volume of 10% of NC, these indicators begin to decrease: $T_{melt.}=100^0C$; $T_{depol.}=340^0C$; $T_{ter.oxi.}=300^0C$; $\Delta m=50\%$.
4. Thermodestruction studied by DTA method showed that the temperature corresponding to the initial endothermic peak and thermal depolymerization in the PP+2.0% NC composite shifts to higher temperatures. This shows that this nanocomposite is more resistant to oxidation.