Abstract

In this project, physical properties of PLA(poly-lactic acid) are studied, as well as the interactions with graphene oxide nanoparticles. PLA is a semicrystalline polymer which is also biocompatible. Measurements of calorimetry. dielectric and desorption of water were carried out. This project was accomplished in the context of general interest in nanocomposite materials.

More specifically 7 samples were used, 1 neat polymer,3 with 0,5 wt%, 1 wt%, 2.5 wt% graphene oxide and 3 with 0,5 wt%, 1 wt%, 2.5 wt% graphene oxide organic modified. At the beginning, calorimetry measurements were conducted using the DSC method and as a result we calculated the glass transition temperature T_g, the percentages of crystallization and the melting temperature. Measurements with various protocols were conducted and conclusions were exported for polymer-filler interaction. Afterwards dielectric measurements were executed using the TSDC and dielectric relaxation spectroscopy (DRS) methods. In TSDC method the range of the temperature was -150-100 ^{o}C and the heating rate was 3 ^{o}C/min. In DRS method the frequency range was 10^{-1}- 10^{6} and the temperature range was -150 - +150 ^{o}C. However, measurements were conducted after crystallization annealing for both methods. Finally, measurements took place, exploiting the dynamic desorption isothermal (DDI) method. In this specific method, the specimens were placed in environment with 98% relative humidity (RH).

The main conclusion, which can be extracted is an increase to the percentage of crystallization in nanocomposites (>70%) as well as an acceleration of crystallization. The percentage of crystallization is greater in samples with organic modification.
In addition, we observe the effect of fillers in dielectric relaxation, as well as dielectric strength of mechanisms. In the end no systematic result were exported for the affection of filler with water, however, an increase of diffusion coefficient is occurred while we increase the amount of filler. New measurements with thicker samples are proposed for safer inferations.

The results were very interesting. Though, due to lack of studying of graphene oxide as a filler in various polymer matrixes, it is necessary to focus more in the study of this specific filler.