Abstract

The main objective of the presented PhD thesis was to obtain and investigate the properties of polymer nanocomposites based on segmented polyester elastomers of poly(ethylene terephthalate) (PET) with dimer of linoleic acid (DLA), containing carbon nanofillers with different aspect ratio, α: carbon black (CB), carbon nanotubes (CNT), and graphene. Two copolymers containing 40 wt% and 60 wt% of hard segments were selected as the polymer matrices differring in their physical properties while maintaining the same chemical structure. Material containing 40 wt% of hard segments as a more flexible one may find potential use as membranes or soft tissue implants. A copolymer containing 60 wt% of hard segments as more rigid material, harder and much easier to process can be potentially used as artificial heart components, implants or polymer fibers.

The results from infrared spectroscopy and nuclear magnetic resonance showed that the addition of carbon nanofillers has no effect on the chemical structure of the obtained nanocomposites. It was proved that carbon nanofillers significantly effect the thermal properties of synthesized materials, where all used nanofillers exhibited a nucleating effect on crystallization and the differences in aspect ratio and their content in polymer matrices influenced the crystallization rate, the amount of crystalline phase and the crystallization kinetics. The mechanical properties of the obtained nanocomposites showed an increase in the Young's modulus with increasing values of the aspect ratio α, but no improvement in tensile strength and elongation at break were observed. The microbiological tests with Gram (-) *Escherichia coli* and Gram (+) *Staphylococcus epidermidis* bacteria showed that bacteria adhesion depends from the surface roughness of soft nanocomposites (PET-DLA 40). In cell studies it was found that both PET-DLA 40 and PET-DLA 60 copolymers, as well as their nanocomposites contaning carbon black and graphene showed adhesion and proliferation of mouse fibroblasts, thus demonstrating good *in vitro* biocompatibility. Exceptions were nanocomposites containing carbon nanotubes, where the lowest fibroblast's viability was observed and no further growth.

Stanisecki
15. 09. 2017