Polymer nanocomposites based on reactive blends of PETG-block-PTMO containing hybrid system of nanofillers

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Due to an increase in the amount of produced packaging polymers, among others, poly(ethylene terephthalate) (PET) and its derivatives, like cycloheksylenedimethanol (CHDM) modified PET (PET-G), the problem of recycling of such materials arises. One can solve this problem by selective collective of post-consumer PET, which can be further convert by way of material or chemical recycling. On the possibilities to obtain new functional materials is to obtain polymer blends, in which the chemically modified recyclate, will consist one of the substrates [1-3]. The aim of this study was to obtain new highly-impact polymer nanocomposites based on post-consumer PETG foils modified with polyglycol (polytetramethylene oxide (PTMO) and hydrid system of nanoparticles: graphene nanoplatelets (GNP), carbon nanotubes (CNT) and nano-size carbon black (nCB).

The series of polymer nanocomposites of PETG-block-PTMO/GNP+CNT+nCB were obtained in the 1dm^3 polycondensation reactor. All nanoparticles are commercially available. In order to obtain the polymer blends, that constitutes the matrix for the nanocomposites, PETG foils scraps were used. Subsequently, the fragmented PETG foils were purified in the acetone in order to remove the colorful print. Poly(tetramethylene oxide) with the molecular mass of 1000g/mol was used as the modifier. The PETG to PTMO ratio equals to 50 wt.%.

As expected, the modification of PETG with PTMO caused a significant improvement in mechanical performance. Introduction of carbon nanotubes, graphene derivatives and carbon black allowed to obtain composites with improved or new physical/utility features with respect to the properties of the matrix, expanding their functional character. The observed improvement in properties, however moderate, if compared to the expectations resulted from exceptional physical properties of carbon nanotubes. However, in the case of hybrid nanocomposites based on PETG-block-PTMO the synergic effect was observed in both mechanical and electrical properties.

References:

[1] Fakirov S., red., Transreaction in condensation polymers, Wiley-VCH, Weinheim, 1999
[2] Matsuda H., Asukara T., Nagasaka B., Sato K., Macromolecules 2004, **37**, 4651
[3] Kwiatkowski K., Rosłaniec Z., P 360451, 2003

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