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Abstract of doctoral dissertation

Influence of nanoparticles and radiation modification on fatigue properties of new thermoplastic elastomers for medical applications

This work describes the synthesis and modification of semi-crystalline poly(aliphatic/aromatic-esters) (PED), and investigation of their thermal and mechanical properties. PED multiblock elastomers are composed from hard segments as in a poly(butylene terephthalate) (PBT) and amorphous dilinoleic fatty acid (DLA) forming the soft segments. Butylene copolymers were prepared in-situ during polycondensation with nanoscale particles of SiO_2 at variable concentration (0.2, 0.5 and 1%wt.), and final products were irradiated with doses of 25 and 50 kGy. The chemical structure of PED copolymers were determined using the ATR-FTIR spectroscopy and ^1H NMR. Phase structure of materials modified by nanoparticle and e-beam radiation was determined from the results of DSC, TEM, DMTA and gel content. Mechanical properties were described by the quasi-static tensile measurements of Young's modulus, and dynamic measurements of short and long term fatigue tests (hysteresis loop methods: SILT and SLT). Results were analyzed in terms of effect of nanoparticles content and radiation dose on selected properties.

The present work describes the effect of addition of nanofiller and radiation modification on physicochemical properties of thermoplastic elastomers PED. The obtained results allowed determine an effect of performed modifications on the mechanical properties and especially fatigue tests of prepared nanocomposites. The results show an improvement in mechanical properties and synergies after e-beam crosslinking. Structural examinations revealed no change in the chemical structure of the prepared materials after e-beam modification and SEM micrographs confirmed good dispersion of the nanofiller in copolymer matrix.

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