Abstract

Thermoplastic polyurethanes (PU) have been widely used for many applications due to their excellent functional properties, recycling included. PUs prepared in this Thesis are based on polycarbonate macrodiols and other bifunctional components, leading to linear solely aliphatic polymer materials.

The main part of this study is focused on synthesis and analysis of polyurethane water dispersions (PUDs) and PUD-based films. The novelty of presented herein research involves ecofriendly method for preparation of thermoplastic PUs based on polycarbonates. The PU nanoparticles dispersed in water were measured by scattering methods, whereas the final films were characterized for their morphology and mechanical, thermal and water resistance. A balance between hydrophilic and hydrophobic parts of PUs for the particles stability and the films properties was investigated as well.

The PUDs were blended with two types of colloidal silica for improve of the PUD-based films resistances with simultaneous preserving of their thermoplastic character. More significant enhancement was observed for the organic-inorganic nanocomposites containing silica with smaller particles, due to creation of higher physical crosslinking density between the nanofiller and PU matrix.

We modified the acetone process of PUDs preparation by elimination of the chain extension step and using of water both as a medium and a crosslinker, leading to more ecological, simpler and cheaper method. We proposed the mechanism of linear and water-crosslinked PU nanoparticles self-assemblies in acetone and in water in two steps of the synthesis.

The second part of this Thesis consists of hydrolytic degradation study of PU elastomers under conditions mimicking the physiological environment. Biostable and biodegradable PUs with or without the degradable unit in PU backbone were investigated for their microstructure by atomic force microscopy and scanning electron microscopy.

Key words: polyurethane water dispersion, thermoplastic polyurethane, polycarbonate macrodiol, organic-inorganic nanocomposite, self-assembly