Propeties Improving of Polyurethane Networks Based on Plant Oil Polyols by Addition of Nanostructures

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Abstract
Polyols derived from plant and animal oils are becoming a new type of cost efficient and environmentally friendly raw materials that are effectively replacing petroleum polyols in production of polyurethanes. Also these materials provide excellent weathering, hydrolytic stability, and resistance against moisture, chemicals and UV radiation they in many cases do not offer desirable physical-mechanical properties. In this work we are showing that incorporation of selected type of nanoparticles into the polymer matrix can overcome this drawback and additionally introduce special properties such as flame retardancy and barrier effect that cannot be normally obtained. We prepared a set of model polyurethane plaques by curing castor oil with aliphatic and aromatic polyisocyanates, where the polyol part was prior to the synthesis homogenized with nanoparticles differing in concentration, shape and surface modification. The used nanoparticles, layered silicate (montmorillonite) and spherical silica, were in the first step hydrophobized and loaded into the polyol part in concentration of up to 10 wt. %. Montmorillonite, providing better results, was in the second step surface modified with special hydrophobization agents introducing on the particle surface hydroxyl groups. We studied the effect of varying concentration and accessibility of these hydroxyl groups to isocyanate groups on chemical reactivity and performance of hydroxy functionalized nanoparticles in polyurethane networks. We characterized the prepared nano-filled polyurethanes by means of chemical resistance, mechanical, dynamic mechanical, and barrier properties and compared to non-filled polyurethanes. Furthermore, the effect of used nanoparticles on rheology, i.e. viscosity of polymers during their processing. The obtained results will be discussed.

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