

## ADHESION OF THERMOPLASTIC POLYMERS: INFLUENCE OF NANOPARTICLES

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### Abstract

Thermoplastic polyurethanes (TPUs) are multi-phase segmented polymers that exhibit a two-phase microstructure (phase separation), which arises from the incompatibility between the soft and the hard segments. The hard rigid segment segregates into a glassy or semicrystalline domain, and the polyol soft segments form amorphous or rubbery matrices in which the hard segments are dispersed [1].

Fumed silicas (nanosilicas) are fillers commonly added to improve the thermal, rheological and mechanical properties of TPU's [2–7]. This improvement in properties has been previously ascribed to the creation of hydrogen bonds between the hydroxyl groups on the nanosilica surface and the soft segments of the polyurethane, favoring the degree of phase separation [8–11]. Previous experimental evidence [12, 16-20] has corroborated the formation of hydrogen bonds between the nanosilica and the polyurethane.

To analyze in depth the creation of hydrogen bonds between the nanosilica and the polyurethane and its incidence in the structure and properties of TPU's, nanosilicas with different silanol contents were added to thermoplastic polyurethanes. Specific surface area is inversely related to the primary particle size of nanosilica, and the greater the specific surface area the greater the silanol content. If hydrogen bond formation is responsible for improving the properties of nanosilica–polyurethane mixtures, it can be expected that the greater the silanol content in the nanosilica, the more noticeable the extent of phase separation in the polyurethane should be; therefore, 2wt% of different nanosilicas was added to a TPU and the mixtures obtained were characterized by FTIR spectroscopy, DSC, X-ray diffraction, plate–plate rheometry, adhesion tests, DMTA and TEM.

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