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MECHANICAL PROPERTIES AND ABRASION WEAR RESISTANCE OF PU/AL2O3 NANOCOMPOSITES PREPARED BY SOLUTION MIXING

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In this paper, polyurethane matrix nanocomposites reinforced with aluminum oxide (Al2O3) nano-particles were fabricated by means of solution mixing method in order to improve abrasion wear resistance of the neat polyurethane (PU). The effects of Al2O3 content and surface modification with silane coupling agent (amino propyl trimethoxy silane (APS)) on the mechanical properties and abrasion wear resistance of the nanocomposites were investigated. Both the tensile strengths and the elongations at rupture of the nanocomposites were found to decrease with the content of Al2O3 nanoparticles; however, the hardness increased gradually. The silane functional groups modified the nanoparticles surface, thus reducing the surface energy, and consequently improving the compatibility of the nano-Al2O3 with the PU matrix. The qualitative grafting of APS amine group on the nanoparticles surface was evaluated by Fourier transform-infrared spectroscopy (FTIR) which confirmed the formation of double bonds of silane coupling agent on the surface of Al2O3 nanopowders. Results revealed that surface treatment of Al2O3 nano-particles with APS better improves abrasion wear resistance of the filled matrixes in comparison to un-modified particles incorporated into the polyurethane. The fracture surfaces of tensile samples and worn areas of the nanocomposites were analyzed with scanning electron microscope (SEM) and the abrasion wear mechanism was discussed.