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Synthesis and Mechanical Characterization of PU and TiO_2 Composites

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Polyurethanes (PUs) are one of the most versatile and used polymeric materials. They represent a class of polymers that has found widespread use in the medical field, automotive and industrial[1]. The present work aims at synthesis and characterization of polyurethane with inorganic nanocharges of titanium oxide (TiO_2), with the purpose of improving its mechanical properties. The material formation was made adding 50% calcium carbonate ($CaCO_3$) in mass the mixture of polyol and diisocyanate at 1:1 ratio. It was mixed until its complete homogenization. We placed them in molds which were placed in pressure vessel at 5ATMs for 48 hrs. The materials were characterized using X-ray diffraction (XRD), infrared spectroscopy (FTIR), and tensile tests were performed. X-ray diffraction patterns and FTIR showed that the materials presented bands corresponding to the anatase TiO_2 phase (JCPDS: 21-1272) indicating that the TiO_2, was inserted into the materials. The tensile tests results presented the real values for the tensile strength, Young modulus, and maximum strain. The doped material tensile strength (39.52 MPa) was slightly smaller than the value for pure polyurethane (42.67 MPa). Furthermore, the latter strain exhibited a drastic decrement, from 28.2% (pure PU) to 4.57% (doped PU). TiO_2 addition highly improved the polymer stiffness, given that PU and doped PU Young modulus were, respectively, 1.42 GPa and 2.39 GPa.

Reference:

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