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ELECTRICAL AND THERMAL PROPERTIES OF POLYURETHANE/CARBON NANOTUBES COMPOSITES

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Polyurethane (PU) is an interesting polymer due to its versatility, since a wide range of properties may be achieved depending on the chemistry of the monomers used, their functionality and molecular weight. This versatility led to the use of polyurethanes as foams, elastomers, coatings, sealants, and adhesive-based products. Polyurethanes present excellent chemical stability, good mechanical properties, and, as most polymers, they are electrically and thermally insulating materials.

Special applications of PU foams would benefit in the combination of the polymer structural properties with electrical and thermal conductivity. This combination of properties may be achieved by the addition of small amounts of a highly conductive nano-reinforcement such as carbon nanotubes (CNT).

The aim of this work was to study the effect of dispersing small amounts of CNT on the thermal diffusivity and electrical resistivity of PU/CNT composites. The PU nanocomposites were prepared with 0.5% and 1% weight of CNT. The composites were prepared by dispersion of the CNT in poly(propylene glycol) (PPG) followed by *in situ* polymerization, by mixing with 4,4′-Methylene di-*p*-phenyl diisocyanate (MDI). The PPG was characterized by an average molecular weight of 425 g/mol and a hydroxyl value 250 to 276 mg KOH/g. The MDI was characterized by a isocianate value (%NCO value) of 27.9-29.2.

It was observed that the thermal diffusivity slightly increased with the addition of the CNT, but the results obtained were within the typical range for polymers (in the order of 10^{-8} m^2/s). The electrical resistivity measured for the composites showed a large decrease after the addition of 0.5% and 1% of CNT. The electrical resistivity decreased 3 and 7 decades (from 10^9 Ω.m to 10^6 and 10^3 Ω.m) for 0.5 and 1% CNT composites, respectively. Thus, the composite bearing 1% of CNT dispersed in the PU presented semiconductor behaviour.

Keywords: Carbon nanotubes; polyurethane; thermal properties; electrical properties