Topic : Nanostructures and nanoparticles based materials

Large deformation sensors base on thermoplastic elastomer/ carbon nanotubes composites

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Thermoplastic elastomers are interesting materials due to their mechanical properties, allowing large deformations that can be suitable, for example, for the development of deformation or pressure sensors. Thermoplastic elastomers (TPE) tri-block copolymer styrene-butadiene-styrene (SBS) composites filled with carbon nanotubes (CNT) are developed and characterized with the main goal of obtaining piezoresistive composites suitable for large deformation sensor applications. SBS/CNT composites with different filler contents and functionalization are characterized by morphologic, thermal, mechanical and electrical analyses. Electrical properties are strongly dependent of CNT dispersion in the polymer matrix, affecting electrical percolation threshold.

SBS/CNT composites have been produced in the form of films by solvent casting, by electrospinning in the form of nano/microfibers and in an industrial extruder machine. The produced elastomeric composites show proper piezoresistive properties. Piezoresistive properties of the SBS/CNT composites have been analyzed at larges strain, until 50%, and different deformation speeds. Sensibility of the composites can reach gage factors up to ~100, being among the best values obtained for polymer composites.

The dependence of the gauge factor on matrix and filler properties and processing conditions as well as some unique applications developed with these composites will be presented and discussed.

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