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Piezoresistivity of Natural Rubber/Thermally Reduced Graphite Oxide Nanocomposites

Mehrdad Yazdani-Pedram, Héctor Aguilar-Bolados
Faculty of Chemical and Pharmaceutical Sciences, Universidad de Chile, S. Livingstone Pohlhammer 1007, Santiago, Chile
myazdani@ciq.uchile.cl; haguilar@ciq.uchile.cl

Miguel Ángel López-Manchado
Instituto de Ciencia y Tecnología de Polímeros (ICTP), CSIC,
Juan de la Cierva 3, 28006, Madrid, Spain
lmanchado@ictp.csic.es

Extended Abstract

High electrical conductivity and flexibility are important properties that nanocomposites of natural rubber (NR)/thermally reduced graphite oxide (TRGO) may present. The preparation of NR/TRGO nanocomposites by dispersion of aqueous suspensions of TRGO in NR latex and their characterization has been reported by Aguilar-Bolados *et al*. These nanocomposites exhibited electrical conductivities up to 10^{-5} S/cm. NR/TRGO nanocomposites were subjected to significant tensile elongation, recovering almost their original length once the applied force was removed. Here we report the results obtained from the study of the effect of the tensile deformation on the electrical properties of NR/TRGO nanocomposites. This deformation could affect the electrical conductivity of the nanocomposite due to the changes in the orientation and/or distribution of the TRGO percolation network in the nanocomposite during elongation. The understanding of changes that occurs in the percolation network of TRGO could be followed by studying the piezoresistive response of nanocomposites. The piezoresistive response consists in the variation of electrical resistivity of a material when it is submitted to a determined type of deformation. Piezoresistive response of NR/TRGO nanocomposites was studied by determining the variation of electrical resistivity as function of tensile elongation.

Tensile elongation of NR/TRGO nanocomposites was performed by using a Shimatzu model AG 1-100 dynamometer with a load cell of 100 N and the electrical resistivity was measured during elongation by using a Keithley model l6517-B high resistivity tester. The most relevant result obtained is the considerable increase of the resistivity of nanocomposites for elongations over 50 %, achieving values of resistivity changes over 1000 %. This is attributed probably to the fact that the TRGO percolation network is highly sensible to the tensile elongation, which could affect the distribution of TRGO particles in the polymer matrix and the possible loss of contact among TRGO particles. Moreover, the morphology and degree of dispersion of TRGO in the polymer matrix was studied by using SEM and TEM microscopies. The results indicated that the TRGO nanoparticles are homogeneously dispersed and completely embedded in the NR matrix.

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