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Influence of the morphology of carbon nanostructures on the piezoresistivity of hybrid natural rubber nanocomposites

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Abstract

The electrical and piezoresistive response of hybrid nanocomposites comprising a combination of few-layer thermally reduced graphite oxide (TRGO) and multiwall carbon nanotubes (MWCNTs) mixed with natural rubber is reported. The influence of the structure and morphology of the TRGO, and MWCNTs on the electrical and piezoresistive response of these nanocomposites is examined. All composites showed a different nonlinear piezoresistive behavior depending on the nanostructure (or combination) used. The hybrid combination of 2 wt.% TRGOs and 2 wt.% MWCNTs increased the electrical conductivity of the polymer 13 orders of magnitude, change that was not possible to achieve by using only TRGOs. This outcome can be attributed to the formation of a highly interconnected percolation network, and indicates that the morphology of the nanostructure plays a paramount role in the electrical and piezoresistive behavior of the nanocomposite. Platelet-type carbon nanostructures of the graphene family used as fillers for polymer composites may not outperform the electrical behavior of rod-type ones such as MWCNTs, but a tailored combination of both may be beneficial for the development of piezoresistive-based sensors.

Keywords: Thermally Reduced Graphite Oxide; MWCNT; Natural Rubber Nanocomposites; Piezoresistivity.

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