

Conductive Natural Rubber Composites based on Conductive Carbon Black, Carbon Nanotubes

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ABSTRACT

Conductive epoxidized natural rubber (ENR) composites were prepared and the ENR 50 mol% epoxide (ENR-50) revealed higher mechanical properties, electrical conductivity and dielectric properties than ENR-25 and unmodified natural rubber (NR) composites. Then, ENR-50 was selected to prepare filled rubber composite with conductive fillers (i.e., conductive carbon black (CCB), short and long multi-walled carbon nanotubes (S-MWCNTs and L-MWCNTs, respectively). It was found that the ENR/S-MWCNTs composites showed superior electrical conductivity, dielectric properties and mechanical properties compared to the ENR/L-MWCNTs and ENR/CCB composites. Furthermore, ENR composites with S-MWCNTs showed the lowest percolation threshold concentration at 1.2 phr while value for the composites with CCB was 15 phr. However, the percolation threshold of the L-MWCNTs filled composites was not reached. In addition, the effect of ionic liquid (IL) in the NR composites was also investigated. It was found that the presence of IL influenced on acceleration of the cure characteristics by reducing scorch and cure times. Furthermore, the electrical conductivity and dielectric permittivity were improved due to the addition of IL. It was also found that the 5 phr of IL in ENR vulcanizates and 3 phr in ENR/MWCNTs/IL composites were the best possible content to optimize the electrical conductivity, dielectric properties and mechanical properties.