OP-3-1009

Wednsday, May 11, 2011, 11:30-11:50 am
Room: Ambassadeurs

IMPACT OF SYNERGY BETWEEN CARBON NANOTUBES AND CARBON BLACK ON THE RHEOLOGICAL AND ELECTRICAL PROPERTIES OF AN EPDM RUBBER

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The outstanding properties of carbon nanotubes (high tensile modulus [1], high electric conductivity [2], and high aspect ratio) make them ideal candidates for use in nanocomposites, and particularly in those based on rubber matrix [3]. However, to obtain an improvement of the properties, a good degree of dispersion of the CNT in the matrix is crucial. It was shown that the grafting of blocks copolymer onto nanotubes surface [4, 5] or their encapsulation by a copolymer [6] improved this individualization. Nevertheless, an approach of the CNT surface modification or a polymerization in the presence of the NTC (polymerization in situ) [7] seems two ways which are very difficult to be transposed in the industry. The CNT dispersion in an EPM rubber is investigated here by using a statistical copolymer as dispersing agent. An association between the EPM and the ethylene-*co*-vinyl acetate (EVA) being very current in the rubber industry, and we chose to investigate this way because EVA exhibits a good affinity with the CNT and improve their dispersion [8, 9]. We studied more exactly the influence of various parameters (EPM/EVA ratio, matrix viscosity) on the CNT dispersion and prepared an EPM-EVA master batch loaded with 20% of CNT and possessing very good conductive properties. In this study, we work with the classic methods used for rubber mixing, like an internal mixer and an open two roll mill, which are soft mixing techniques. We studied more exactly EPDM compound filled with carbon nanotubes, carbon black or the blend of both. We will present the influence of fillers and their possible synergy on the rheological and electrical properties. In particular, we will compare the rheological and electrical percolation thresholds in the presence of fillers and will quantify their impact on the vulcanization kinetics of elastomers. We will demonstrate that the dilution of the master batch allows to obtain a rubber filled with a constant Mooney viscosity. The synergistic effect between carbon black and carbon nanotubes will be shown on the mechanicals properties but not on the electrical properties.