Microstructure property correlation of latex assisted functionalized multi-walled carbon nanotube reinforced elastomeric nanocomposites

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ABSTRACT

Traditionally, carbon black is used as filler material with elastomer matrix towards enhancement of strength and durability of the matrix material. However, with increasing demands for performance improvement, growing competition, and imminent government regulations, carbon black is unable to fulfil the stringent requirements. Besides, as a filler, carbon black has limitations in terms of performance enhancements, and a large filler content is often prescribed. To this end, this study has focused on development of functionlized multi-walled carbon nanotubes (*f*-MWCNT) reinforced engineered natural rubber (NR)/poly butadiene rubber (PBR) blend nanocomposites. Ultrasonication assisted latex mixing process was used to incorporate the nanofillers. Further, high speed mechanical perturbation and probe sonication were employed to ensure efficient dispersion of *f*-MWCNT nanofillers, followed by co-coagulation of the nanofiller dispersed latex blends. A systematic variation of *f*-MWCNT content was carried out to investigate the effect of incorporation of the nanoparticles within the elastomeric matrix blends. The microstructure and static mechanical properties of the nanocomposites were then evaluated. Fourier transform infrared spectroscopy (FT-IR) studies indicated possible chemical interactions between the functional groups present in the blended elastomers and *f*-MWCNT. Scanning electron microscopy (SEM) revealed microstructural details of the nanocomposites which in turn could be attributed to superior mechanical behavior of the developed elastomeric nanocomposites. Thermogravimetric analysis (TGA) further revealed enhanced thermal degradation behaviour of the elastomeric nanocomposites. Overall, the results have established that with a small loading level of *f*-MWCNT, unique material and process combination along with efficient dispersion technique used in this study have the potential to develop high performance elastomeric nanocomposites.

Keywords: Natural rubber, Multi-walled carbon nanotube, Mechanical properties, Nanocomposites