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Value Addition to Natural Rubber by Enhancing Electrical Conductivity through the Incorporation of Carbon Nanotubes

Mapalagama C.M.[1], Pamunuwa K.M.P.P.K.[1*], Abeysinghe A.A.D.T.[1], Ekanayake S.A.[1], Sirimuthu N.M.S.[1], Fernando E.J.[2], Etampawala T.N.B.[2], Karunanayake L.[2], Kumarasinghe A.R.[3]

[1]Department of Chemistry, University of Sri Jayewardenepura, Nugegoda, Sri Lanka
[2]Department of Polymer Science, University of Sri Jayewardenepura, Nugegoda, Sri Lanka
[3]Department of Physics, University of Sri Jayewardenepura, Nugegoda, Sri Lanka
**p.pamunuwa@gmail.com*

Abstract

Rubber sector is the third largest export earner in Sri Lanka thus; natural rubber has acquired the status of a globally significant industrial raw material. Hence, value addition to natural rubber has become increasingly important in developing rubber products with enhanced properties in order to meet the industrial demand. This study was conducted with the aim of improving the electrical conductivity of natural rubber latex through the incorporation of carbon nanotubes (CNT). Electrically conductive rubber materials are important to shield devices from electromagnetic radiation by discharging electrical charges which are accumulated when rubber is used in contact with electro sensitive material. Commercial applications of conductive rubber include; conductive tyres and gloves, stretchable conductors and antistatic coatings. In this study, CNT were synthesised using a chemical method and characterised using Raman spectrometer, UV visible spectrophotometer, XRD analysis, TEM and FT-IR spectrometry. Produced CNT were used as a conductive filler in preparing rubber nanocomposites. A series of rubber compounds were formed by varying the phr of CNT from 0-5. The electrical conductivity of these samples was determined using the Four- point probe conductivity meter and an increase in conductivity was observed compared with the control rubber sample. The electrical conductivity of pristine rubber was found to be 4.58×10^{-6} S/m. Addition of CNT showed a thousand fold improvement (2.49×10^{-3} S/m). This value lies in the antistatic range thereby proving its ability to neutralise the accumulated static charges. In addition to electrical conductivity, thermal conductivity and mechanical properties such as tensile strength, young's modulus, elongation at break, hardness of CNT incorporated latex samples were measured and a significant improvement was observed in these properties. Results of this work give a promising insight towards the development of a novel rubber material with improved electrical and mechanical properties. Therefore, it can be concluded that the incorporation of CNT would be a value addition to natural rubber thus paving the way for the development of a highly profitable export material which will be beneficial for the local economy.

Keywords: Natural rubber latex, Carbon nanotubes, Electrical conductivity