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Investigation of electrical properties of composite dipped films developed with Electrically Conductive Carbon nanotube (CNT)-Natural Rubber Latex (NRL)

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Electrically conductive NRL dipped films are important in applications such as electrically conductive gloves, sensing applications and in electromagnetic interference shielding (EMIS) due to their light weight, low thickness, and cost effectiveness. This study focused on developing electrically conductive thin NRL dipped films by aligning CNTs in the latex medium by the application of an Electric field. Angled multiple dipped article preparation was carried out with (a)compounded latex (CL), (b) CL with dispersed CNTs and (c) CL with dispersed CNTs under the effect of an electric field induced using an external power supply. The dipped films were characterized by Raman, FTIR, TGA and Tensile strength analyses. The comparison of ID/IG ratio obtained from the Raman study revealed the presence of a higher proportion of graphitic carbons in composite films compared to the multi-walled CNT (MWCNT) sample due to the elimination of the non-graphitic constituents of MWCNT during solubilizing. By observing the TGA, we can confirm the presence of MWCNT. A slight decrease of tensile strength was observed in the dipped composite films compared to the plain latex films, indicating the CNT's role as a non-reinforcing filler. The electrical conductivity and the EMIS effectivity of the films were investigated using a four-probe conductivity meter and a portable oscilloscope, respectively. An electrical conductivity within the range of 0.0002-0.002 Sm^{-1} was determined and an initial reduction in intensity of attenuated EMR was observed only in the (c) films, suggesting the presence of an effectively aligned mesh structure of MWCNTs within the CL matrix.

Keywords: Natural rubber latex, Carbon nanotube, Dipped film, Electrical conductivity, Electromagnetic interference shielding

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