World Academy of Science, Engineering and Technology
International Journal of Materials and Textile Engineering
Vol:13, No:05, 2019

Identification of the Best Blend Composition of Natural Rubber-High Density Polyethylene Blends for Roofing Applications

Authors : W. V. W. H. Wickramaarachchi, S. Walpalage, S. M. Egodage

Abstract : Thermoplastic elastomer (TPE) is a multifunctional polymeric material which possesses a combination of excellent properties of parent materials. Basically, TPE has a rubber phase and a thermoplastic phase which gives processability as thermoplastics. When the rubber phase is partially or fully crosslinked in the thermoplastic matrix, TPE is called as thermoplastic elastomer vulcanizate (TPV). If the rubber phase is non-crosslinked, it is called as thermoplastic elastomer olefin (TPO). Nowadays TPEs are introduced into the commercial market with different products. However, the application of TPE as a roofing material is limited. Out of the commercially available roofing products from different materials, only single ply roofing membranes and plastic roofing sheets are produced from rubbers and plastics. Natural rubber (NR) and high density polyethylene (HDPE) are used in various industrial applications individually with some drawbacks. Therefore, this study was focused to develop both TPO and TPV blends from NR and HDPE at different compositions and then to identify the best blend composition to use as a roofing material. A series of blends by varying NR loading from 10 wt% to 50 wt%, at 10 wt% intervals, were prepared using a twin screw extruder. Dicumyl peroxide was used as a crosslinker for TPV. The standard properties for a roofing material like tensile properties tear strength, hardness, impact strength, water absorption, swell/gel analysis and thermal characteristics of the blends were investigated. Change of tensile strength after exposing to UV radiation was also studied. Tensile strength, hardness, tear strength, melting temperature and gel content of TPVs show higher values compared to TPOs at every loading studied, while water absorption and swelling index show lower values, suggesting TPVs are more suitable than TPOs for roofing applications. Most of the optimum properties were shown at 10/90 (NR/HDPE) composition. However, high impact strength and gel content were shown at 20/80 (NR/HDPE) composition. Impact strength, as being an energy absorbing property, is the most important for a roofing material in order to resist impact loads. Therefore, 20/80 (NR/HDPE) is identified as the best blend composition. UV resistance and other properties required for a roofing material could be achieved by incorporating suitable additives to TPVs.

Keywords : thermoplastic elastomer, natural rubber, high density polyethylene, roofing material
Conference Title : ICSPCMS 2019 : International Conference on Synthetic Polymer Chemistry and Materials Studies
Conference Location : Singapore, Singapore
Conference Dates : May 02-03, 2019