Preparation Static Dissipative Nanocomposites of Alkaline Earth Metal Doped Aluminium Oxide and Methyl Vinyl Silicone Polymer

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Abstract : Methyl vinyl silicone polymer (VMQ) - alkaline earth metal doped aluminium oxide composites are prepared by conventional two rolls open mill mixing method. Doped aluminium oxides (DAO) using silvery white coloured alkaline earth metals such as Mg and Ca as dopants in the concentration of 0.4 % are synthesized by microwave combustion method and referred as MA (Mg doped aluminium oxide) and CA (Ca doped aluminium oxide). The as-synthesized materials are characterized for the electrical resistance, X–ray diffraction, FE-SEM, TEM and FTIR. The electrical resistances of the DAOs are observed to be ~ 8-20 MΩ. This means that the resistance of aluminium oxide (Corundum) α-Al2O3 which is ~ 1010Ω is reduced by the order of ~ 103 to 104 Ω after doping. XRD studies reveal the doping of Mg and Ca in aluminium oxide. The microstructural study using FE-SEM shows the flaky clusterous structures with the thickness of the flakes between 10 and 20 nm. TEM images depict the rod-shaped morphological geometry of the particles with the diameter of ~50-70 nm. The nanocomposites are synthesized by incorporating the DAOs in the concentration of 75 phr (parts per hundred parts of rubber) into VMQ polymer. The electrical resistance of VMQ polymer, which is ~ 1015Ω, drops by the order of 108Ω. There is a retention of the electrical resistance of ~ 30-50 MΩ for the nanocomposites which is a static dissipative range of electricity. In this work white coloured electrically conductive VMQ polymer-DAO nanocomposites (MAVMQ for Mg doping and CAVMQ for Ca doping) have been synthesized. The physical and mechanical properties of the composites such as specific gravity, hardness, tensile strength and rebound resilience are measured. Hardness and tensile strength are found to increase, with the negligible alteration in the other properties.

Keywords : doped aluminium oxide, methyl vinyl silicone polymer, microwave synthesis, static dissipation
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