ABSTRACT

The thesis deals with the development of conductive composites to be used for Electromagnetic Interference (EMI) shielding application. These conducting composites are based on Polyvinylidene Fluoride (PVDF) filled with different kinds of carbon filler like Short Carbon Fiber (SCF), Multiwalled Carbon Nanotube (MWCNT), particulate Carbon blacks (N472), (N550) and (N774). All composites were prepared by solution mixing followed by molding. DC conductivity as well as AC conductivity and dielectric properties were measured over the frequency range 10 – 10^6 Hz whereas electromagnetic interference shielding effectiveness (EMI SE) of these composites were measured in X-band frequency region (8.2 – 12.4 GHz). The effect of temperature on DC conductivity has also been investigated. Both Negative Temperature Coefficient (NTC) and Positive Temperature Coefficient (PTC) with respect conductivity were observed depending upon type and concentration of filler used. The applicability of different theoretical models to predict the composition dependent conductivity of different composites were also checked. Theoretical conductivity calculated from some of these models are found to be in good agreement with experimental values for different composites. The effect of aspect ratio (length/diameter) for SCF on AC and DC conductivity values of PVDF/SCF composites were investigated in detail. The formation of the conductive networks through aggregation of SCF particles in matrix polymer was found to depend on the aspect ratio of SCF which in turn affect both AC and DC conductivities. The distribution of different types of fillers in PVDF matrix has been checked from morphological studies (FESEM and TEM). Semi-transparent conductive composites with good EMI SE could be developed from PVDF/MWCNT and PVDF/SCF composites.

Keywords: Electrical conductivity, Dielectric properties, EMI shielding, Mechanical properties, Polymer composite, Aspect ratio, Percolation threshold, Filler loading.