Abstract

Studies on the unfilled chlorosulfonated polyethylene rubber (CSM) with curing agent variation have been carried out with respect to physico-mechanical, dynamic rheological properties to optimize the curing system. Studies on the physico-mechanical and rheological properties reveal that both peroxide and sulfur curing systems exhibit superior properties. Effect of conductive carbon black on CSM rubber has been studied with respect to physico-mechanical, dynamic mechanical, electrical and dynamic rheological behavior. Dispersion of carbon black particles in the polymer matrix has been studied with the help of scanning electron microscopy (SEM) and transmission electron microscopy (TEM). SEM and TEM photomicrographs for all compositions reveal homogeneous dispersion of carbon black particles at low filler loading. Tensile and tear strength are found to increase with increase in filler loading up to 30 phr (parts per hundred rubber) filler loading beyond which they decrease. 30 phr of Ensaco 350G is found to be optimum filler loading for CSM rubber. The polymer-filler interaction for carbon black filled CSM rubber composites have been evaluated by bound rubber content, which increases with increase in carbon black loading. Dynamic mechanical analysis shows that the effect of carbon black loading has marginal effect on glass transition temperature (T_g). Non-linearity in storage modulus with variation of double strain amplitude (DSA) increases with increase in carbon black loading. Real part of the complex impedance shows a gradual reduction with frequency, whereas imaginary part of complex impedance shows a gradual increase with frequency. Abrupt increase in electrical conductivity at 30 phr carbon black loading confirms the percolation threshold. Increase in dielectric permittivity and ac conductivity with increase in filler loading has been observed at all temperatures. Dynamic rheological properties of CSM rubber composites as a function of strain, frequency and temperature have also been reported. Strain dependent storage modulus decreases with increase in strain amplitude. Correlation study between electrical and rheological percolation reveals that the rheological percolation threshold detected from dynamic rheological measurement coincides with the electrical percolation threshold. The capillary rheological behavior of CSM rubber composites shows that the shear stress and shear viscosity increase with increase in carbon black loading and decrease with increase in DOP (dioctyl phthalate) loading. Activation energy decreases with increase in carbon black and DOP loading. In the present investigation novel conductive carbon black filled sulfur/peroxide crosslinked CSM vulcanizates with a marked improvement in technical properties have been developed, which broaden the interesting fields of application with main focus on electronics, automotive and radioactive fields.

Keywords: *Chlorosulfonated polyethylene, Physico-mechanical properties, Reinforcement, Viscoelastic properties, Conductivity, Percolation.*