ABSTRACT

A commercial cryo-ground rubber tire (GRT) has been characterized, surface modified and utilized in thermoplastic matrices. It has been observed that finer particulate ground rubber contains less polymers, but higher amount of fillers and metals. Higher amount of metals in smaller particles is responsible for the increased degradation of the natural rubber vulcanizate during aging. Rubber hydrocarbon content in GRT (rGRT) has been used for partial replacement of the rubber in a rubber/plastic blend based on EPDM and acrylated HDPE (A-HDPE). A 60/40 rubber/plastic blend based on (EPDM+rGRT)/HDPE shows thermoplastic elastomeric (TPE) behavior where rubber phase consists of an optimum mixture of EPDM and rGRT (1:1). GRT has been modified by grafting with maleic anhydride. Maleic anhydride moiety in the maleated GRT (m-GRT) reacts with unreacted ZnO present in the GRT to form a salt. Maleated GRT in the TPE composition imparts greater physical properties than the non-maleated counterpart due to the interaction between m-GRT and A-HDPE.

GRT has been chlorinated by trichloroisocyanuric acid (TCICA) solution in methanol. Both surface energy and dielectric constant of GRT at 30°C increase with increase in degree of chlorination, reach a maximum at 3% concentration of TCICA solution, beyond which the surface energy and dielectric constant decrease. When chlorinated GRT of different chlorine contents is used as a filler in a PVC plastisol at a fixed loading (40 phr), physical properties of the PVC blend containing chlorinated GRT are greater than those of the blend containing unmodified GRT. The properties of PVC/chlorinated GRT blend is maximum in the case of 3% TCICA solution treated GRT (Cl-GRT). While activation energy for the dielectric relaxation of the PVC phase is not influenced by the presence of GRT in the compound, presence of chlorinated GRT lowers the activation energy, indicating higher degree of compatibility through dipole-dipole interaction between PVC and chlorinated GRT. A maximum 40 phr of Cl-GRT may be loaded in a PVC plastisol, beyond which physical properties are adversely affected. The PVC/Cl-GRT composite also exhibits reprocessability characteristics of a melt processable rubber. The PVC compound filled with Cl-GRT exhibits higher elasticity and viscosity compared to the control GRT filled compound. PVC/GRT blend exhibits higher die swell, higher

degree of surface roughness and melt fracture than that of the PVC/Cl-GRT blend due to poor matrix-filler adhesion in PVC/GRT system.

Key words: Ground rubber tire (GRT), EPDM rubber, acrylated HDPE, thermoplastic elastomer, dynamic mechanical thermal analysis, maleated GRT, X-ray photoelectron spectroscopy, diffuse reflectance infrared spectroscopy, trichloroisocyanuric acid, chlorinated GRT, attenuated total reflectance infrared spectroscopy, PVC plastisol, dielectric analysis, compatibility, activation energy for dielectric relaxation, activation energy for melt flow, melt processable rubber, thermorheological analysis, elasticity, viscosity, die swell.