Abstract

Chlorinated polyethylene (CPE) with 36% chlorine content is a specialty elastomer with unique range of properties like excellent chemical, weathering, oil and ignition resistance. Furthermore, its major area of applications is electrical cable insulation, jacketing, automotive under-the-hood, geomembrane, and chemical flooring. However, the major drawback with CPE is evolution of toxic and corrosive hydrochloric acid gas once it catches fire. This many a time becomes a matter of concern for its use in closed apartment or buildings. Blending of non-halogenated polymer having similar characteristics with CPE could be an effective technique to dwindle away the limitation of CPE. Ethylene methacrylate copolymer (EMA) has turned out as a potential candidate to effectively serve this purpose. EMA exhibit several characteristics that are close to CPE. In order to understand the degree of compatibility the CPE/EMA blends possess, detail thermal study was carried out over its entire composition range. Mechanical property, thermal degradation stability, oil, and flame resistance, and electrical properties were measured. The CPE/EMA (60/40) blend system was found to be optimum in terms of mechanical and thermal properties. Also, nanocomposites of optimized CPE/EMA (60/40) blends were prepared using layered silicates, halloysite nanotubes (HNTs), and sepiolite needles. All the inorganic nanofillers were covalently modified with poly(ε-caprolactone) (PCL) by *in-situ* ring opening polymerization of ε-caprolactone and commonly used organosilane modifier (3-aminopropyl)triethoxysilane (APTES). The morphology of unmodified and modified nanofillers and their respective nanocomposites were checked through HRTEM, FESEM, AFM and XRD analysis. Better states of filler dispersion in covalently modified nanofiller based nanocomposites were responsible for the improved mechanical and thermal properties. Also, the oil resistance, flame resistance and volume resistivity of these nanocomposites were measured. Besides, the optimized CPE/EMA (60/40) blend was co-crosslinked with dicumyl peroxide (DCP) in order to enhance the technological compatibility of the blend system and thereby improve the overall mechanical properties. The vulcanizate with 1.5 wt% of DCP was the optimum peroxide concentration with 78% increment in ultimate tensile strength. The complete work represents a thorough understanding on the structure-property relationship of CPE/EMA blend, its nanocomposites and vulcanizates.

Keywords: Chlorinated polyethylene, covalent modification, polymer-filler interaction, morphology, mechanical property.