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Enhancement of mechanical, thermal and morphological properties of compatibilized graphene reinforced dynamically vulcanized thermoplastic elastomer vulcanizates based on polyethylene and reclaimed rubber

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Abstract

The effect of graphene nanoplatelets (GnPs) introduction into the compatibilized multiphase polymer systems such as dynamically vulcanized thermoplastic elastomers (TPVs) based on linear low density polyethylene (LLDPE) and reclaimed rubber (RR) was explored through using the experimental and theoretical analysis. The nanocomposites were prepared by using traditional melt mixing method and characterized by various experimental measurements including transmission electron microscopy (TEM), scanning electron microscopy (SEM), differential scanning calorimeter (DSC), thermogravimetric analysis (TGA), Dynamic mechanical thermal analysis (DMTA), tensile test and rheological measurements. The morphological investigations of prepared TPV nanocomposites show the considerable effect of GnPs on the size reduction of rubber droplets. The DSC measurements indicated the role of GnPs as an effective nucleating agent in the TPV nanocomposites. The results of TGA measurements show that the GnPs can cause a higher thermal stability in LLDPE/RR TPVs especially in the presence of a maleated polyethylene (MA-PE) as a compatibilizer. The mechanical properties exploration of TPV nanocomposites represents the considerable effect of GnPs on the increasing of Young's modulus. The analytical stiffness analysis through using Christensen-Lo model with emphasizing the effect of interphase region could precisely