ABSTRACT

Silicone rubber (SR) is one of the important synthetic functional elastomers with its unique properties, such as excellent weather resistance, chemical stability, oxidation resistance, thermal stability, low-temperature toughness, electrical insulation, low surface energy, low toxicity and high optical transparency. The ever-expanding applications of SR require improved mechanical, thermal, reduced flammability and gas barrier properties to endure stringent conditions. In view of this, the present work is focused on development and characterization of 2D and 3D nanofiller reinforced silicone rubber nanocomposites.

The work involves the investigation of the reinforcing effects of dodecyl sulfate (DS) and stearate (St) organomodified 2D layered double hydroxides (LDH) on physicochemical properties of SR nanocomposites prepared by solution intercalation method. The exfoliated and partially exfoliated nanocomposites are formed in St-LDH/SR and DS-LDH/SR respectively. These organomodified LDH filled SR nanocomposites exhibit improved mechanical, dynamic mechanical, thermal and solvent resistance properties compared to neat SR. It is also inferred that St-LDH/SR exhibits superior properties compared to DS-LDH/SR nanocomposites. The mechanical and thermal properties of SR have also been improved by interlayer grafting of organo modified montmorillonite (MMT).

Another new and cost effective approach in the present work involved the preparation of 3D MWCNT/graphene, MMT/MWCNT and LDH (Li-Al-LDH; Mg-Al-LDH and Co-Al-LDH)/MWCNT hybrid nanofillers and investigation of their reinforcing effect in the development of SR nanocomposites. These studies have shown that the properties are in general enhanced in all the hybrid filled SR nanocomposites due to the synergistic effect compared to either neat SR or individually graphene, MWCNT, MMT, LDH filled SR composites. It is concluded that MMT/MWCNT/SR nanocomposites show the maximum enhancement in mechanical properties, whereas dynamic mechanical properties and thermal stability are maximum improved in MWCNT/G/SR nanocomposites.

In conclusion, 2D and 3D nanofillers significantly enhanced the mechanical and thermal properties of SR.

Key words: Montmorillonite, Layered double hydroxide, 3D hybrid nanofiller, Silicone Rubber, Nanocomposites