Abstract

Blending of polymers gained growing interest as it offers tailored properties utilized for suitable applications cost effectively. Fluoroelastomers (FKM) are extensively utilized for their extraordinary oil and heat resistance properties, chemical inertness along with their remarkable mechanical properties owing to strong carbon-fluorine bonds. However, it lacks in low temperature flexibility and possesses inferior processability due to high Mooney viscosity. Conversely, silicone rubbers are well known for their extremely superior low temperature properties, excellent processing behaviour, chemical resistance, insulating properties and weatherability. Hence, blending FKM and methyl vinyl silicone rubber (MVQ) rubber can improve the low temperature properties and the processing behaviour of the FKM, in addition to the oil resistance characteristics of silicone rubber. FKM and silicone rubbers form an immiscible blend due to the huge mismatch of solubility parameter. Therefore, to achieve a technically viable blend system, certain novel routes of compatibilization have been attempted. For this entire work, the advanced polymer architecture based fluoroelastomer and two different grades with varying Mooney viscosity of silicone rubber has been taken. A meagre amount of fluorosilicone rubber and FKM/MVQ based graft compatibilizers were used as compatibilizers. Moreover, the nanofillers like silica/carbon black-silica hybrid filler and externally added third components such as glutaraldehyde were also utilized to improve the compatibility between FKM and MVQ phases. It can be seen that the blend system compatibilized by very minute amount of fluorosilicone rubber (2.5 phr) filled with carbon black-silica hybrid filler (15 phr) shows the foremost property in terms of ageing resistance, rheological behaviour, and thermal stability along with physicomechanical properties. The glutaraldehyde loaded FKM/MVQ blend system depicts a significant increment (34% tensile strength and 107% tear strength increment) in physicomechanical properties compared to the readily available fluorosilicone rubber. However, the graft compatibilizer loaded blend system does not attain satisfactory enhancement of the properties in comparison with expensive fluorosilicone rubber. Altogether, the efficient compatibilization of FKM/MVQ blend has been achieved cost-effectively with superior properties to the fluorosilicone rubber. Hence this blend system can be a substitute for replacing the expensive fluorosilicone rubber in various facets of industrial applications such as oil and fuel resistant seals, gaskets, O-rings, heat resistant smoke dampers, diaphragms and so on.

Keywords: Compatibilization, Fluoroelastomer, Silicone rubber, Fluorosilicone rubber, Polymer blends, Super specialty blends, Heat and oil ageing.