Abstract

Optimum insulation design of elastomeric material with metal case is needed to protect solid rocket motor. During operation, heat insulating layers protect the rocket motor casing from heat and erosion caused by particle streams generated by combustion of the propellant. The insulation liner should have an ablative property which facilitates the formation of thermally insulating char. The gases produced during propellant combustion, typically contain high-energy particles which generates tremendous amount of heat. Thus, it is crucial that insulation should withstand the extreme conditions experienced during propellant combustion and protects the casing from the burning propellant. Elastomeric materials have been investigated and can be used for better insulator, because their thermal and ablative properties are particularly suited for rocket motor applications with some reinforcing fillers. In order to improve the mechanical properties of elastomeric insulation, it has been proposed to reinforce the elastomeric insulation with nanosilica and polyimide. The effect of nanoclay and carbon nanofiber on thermo-mechanical properties was also analyzed. Present study deals with the modification of EPDM to improve its compatibility with the polar fillers which advantageously improves the mechanical, thermal and ablative prpperties of the insulation material. Apart from maleic anhydride (MAH) grafting on EPDM backbone, the effect of blending of commercially available EPM-g-MAH with EPDM was studied in parallel. There are some highly thermally stable fibers [e.g. Polysulphonamide (PSA), Kevlar® (K), Technora® (T) etc.] which can be incorporated to the EPDM matrix with a compatibilizer (Ricon®). A workable formulation was optimized to perform in extreme environmental conditions and hence for high temperature resistant rocket motor insulation. Mechanical, Physical and rheological properties were also investigated. Thermal behavior of the insulating material was studied by TGA, DSC, TMA etc. Besides these, thermal conductivity, thermal diffusivity and specific heat were also measured. Characterization techniques were carried out using FTIR, ATR and XRD. Morphological studies by FE-SEM and HRTEM exhibited uniform dispersion of nanofillers throughout modified EPDM matrix.

Keywords: *Modified EPDM; Polyimide; Thermal properties; High Temperature Insulation; Plasma treatment*