APPLICATION OF POLYMERIC NANO COMPOSITES AT LOW EARTH ORBIT AND GEOSYNCHRONOUS EARTH ORBIT

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Abstract: Use of different polymer or polymeric composites for structural application at space and shielding of electronic instruments under electromagnetic radiation at Low Earth Orbit (LEO: 150 to 3000km from Earth surface) has shown high potential during past few decades. It is to be noted that even interplanetary space mission especially at Geosynchronous Earth Orbit (GEO: 36000 km away from Earth surface) both unmanned and manned missions also searching light weight-high strength vis-à-vis thermally stable and radiation resistance polymer and polymeric composites. Therefore, technology is still evolving to developing polymer and polymer based composites which could be useful as structural materials for spacecraft as well as shielding material when spacecraft is subject to intense radiation at GEO. At GEO, the major primary cosmic radiations of concern are positively charged atomic nuclei, protons, helium nuclei, gamma rays and some heavier nuclei. Many of these are extremely energetic and highly penetrating to be stopped by the modest thicknesses of polymeric material used in LEO spacecraft. Therefore, for space mission at GEO, application of aluminium based composite is still prominent. Therefore, in this investigation attention is given to find an appropriate polymer which could be stable and will exhibit all the desired properties of aluminium with much lighter in weight, and therefore will be an alternative to replacing aluminium. One such space durable polymer is polybenzimidazole (PBI) having service temperature ranges from -260 °C to +500 °C and also having excellent properties to resist high energy radiation and fire. Therefore, this paper highlights polymeric nano composite based on PBI resin with dispersion of appropriate nano particles such as Single Walled Carbon Nano Tube (SWNT) and carbon nano fibre and its proper fabrication by space durable nano adhesive and that could be an alternative solution for materials under space radiation at longer mission under GEO. In this context, the thermomechanical properties of the polymer and polymeric nano composites are carried out by Differential Scanning Calorimetry (DSC), Thermo Gravimetric Analysis (TGA) and mechanical testing under tensile load, and it is observed that there is an improvement in thermomechanical properties of the polymer. Further, in order to understand the influence of space radiation on the polymer and polymeric composites, the polymers are getting exposed to high energy radiation and are analysed for potential application to space at GEO.

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