ABSTRACT

A material intended for space application needs to be stable with respect to their properties for the required duration orbiting in space environment which consists of high vacuum, wide temperature excursions, ionizing radiation and atomic oxygen (ATOX). Polysulfones exhibit outstanding engineering properties and has good resistance to ionizing radiations. Due to large fluence of electron and its low linear energy transfer (LET), degradation of a material in space due to electrons is more. Absorption of γ-radiation in a material produces electrons. In present study, γ-radiation (^{60}Co) has been used as the source for ionization. γ-radiation stability of three polysulfones – poly-sulfone (PSU), poly-ethersulfone (PES) and poly-phenylsulfone (PPSU) in presence of air and argon has been compared. PSU based nanocomposites using different weight % of multi walled carbon nanotube (MWCNT) has been prepared and evaluated for the changes in various properties after exposure to γ-radiation. Optical solar reflectors (OSRs) were fabricated using the three polysulfones and changes in thermo-optical properties measured after subjecting to γ-radiation. γ-radiation effects on RF performance of PSU/ MWCNT composites were also studied. For all the polysulfones, extent of degradation has been less for the samples irradiated in presence of argon. Chain scission has been the cause for degradation in presence of argon and air. PPSU was more stable to γ-radiation than PSU and PES. This is attributed to the presence of biphenyl units in PPSU. The PSU/ MWCNT nanocomposites prepared during this investigation have good radiation stability. These composites have stable thermal vacuum and thermo-optical properties coupled with sufficient surface conductivity for dissipation of electro static charges. Further, they have stable performance in RF frequencies (C – band, X – Band and Ku – Band) even after exposure to 2 MGy of exposure. The developed PSU/ MWCNT will find potential application as (a) thermal control material (flat absorber) and (b) antenna sun shield. The optical solar reflectors (OSR's) prepared from PSU, PES and PPSU indicate promising results as a thermal control material (solar reflector).

Keywords*: Polysulfones, Nanocomposite, γ-radiation, Optical solar reflector, Radio frequency*