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Topic: Investigation of Radiation Induced Effects in Polymers

Abstract

Polymers are one of the important classes of space materials in addition to metals, alloys and ceramics. On account of the rapid developments of the physics and chemistry of polymers during last five decades a process of "polymer engineering" has become a success story of practical applications. Polymers, in addition to their inherent economical superiority can have vast variety of physical and chemical properties, wide range of mechanical parameters, flexibility, lightness, optical transparency, easy processing etc., which have made the polymer science an attractive subject. Current applications are like from adhesives, coatings, foams, packaging materials to textile industrial fibers, composites, electronic devices; biomedical devices, optical devices, space technology, and precursors for many newly developed high-tech ceramics.

In their applications, polymers are bound to get exposed to different radiations like UV-VIS, IR, X-rays, gamma rays, electron, protons and also light and heavy ions. When the ionizing radiation passes through the polymers, it loses its energy by ionizations, excitations and nuclear encounters. A variety of physical and chemical changes takes place due to energy deposition. Radical decomposition, recombination, scissoning, crosslinking, etc. are some interesting changes that are relevant to polymers. The modification in polymer properties by ionizing radiation depends upon the nature of radiation and the type of polymer used. The different types of the polymers were studied with wide range of ion beams/γ-irradiation at low doses.

In present study three types of procured polymers-CR-39, Makrofol-N and Polystyrene-are used for gamma irradiation of high doses up to the dose level of 2000kGy. We have chosen these polymers due to their technological importance in various fields of applications. In the present study we used **γ-**radiation due to its ability to expose the whole area of the material and expected to create homogeneous modifications in it. Besides the possibility of charge bed formation in case of gamma radiation is negligible. Gamma rays irradiations also lead to disruption of chemical bonds and ejection of hydrogen atoms while formation of double bonds – C= C– initiates their clustering. In the present study the following five different analytical techniques, i.e. UV-VIS, XRD, FTIR, HFIA and SEM have been used to find the possible modifications in the selected polymers due to gamma radiation. The brief details of the thesis is given below,

Chapter 1 deals with the introduction of polymers

Chapter 2 deals with the characterization techniques used

Chapter 3 deals with the effects of γ-radiation on CR-39 polymer

Chapter 4 deals with the effects of γ-radiation on Makrofol-N polymer

Chapter 5 deals with the effects of γ-radiation on Polystyrene polymer

Chapter 6 deals with the summary and future plan