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Title of the thesis: ***"Studies of Radiation Induced Changes in Polymers."***

ABSTRACT

Polymers are a class of material widely used in different field of applications. The properties such as flexibility, lightweight, optical transparency etc. and their easy processing have made the polymer science as an attractive field for research. Polymers are very frequently used in fabrication of microelectronic devices and also in the field of nanotechnology.

Gamma-ray photons are a form of ionizing radiation; when they pass through matter, they usually lose their energy by liberating electrons from atoms and molecules. This leads to changes in structural and chemical properties of the polymers. The major processes observed in irradiated polymer molecules are, (i) gas evolution; (ii) creation of double and triple bonds; (iii) main chain scissions reducing mechanical strength; (iv) combination of macro radicals link of the polymer chains with one another, generating cross-linked structures.

In present case, three types of procured polymers (Polyvinylidene fluoride, Polymethyl methacrylate and Ultra-high molecular weight polyethylene) are used for gamma irradiation. The obtained results are given in the following table

Type of Polymer	Thickness of the film	Gamma radiation dose (kGy)	Characterization techniques used	Main changes observed due to gamma irradiation
PVDF	**80 μm**	**0, 48, 110, 174 and 300 kGy**	**UV-VIS FTIR XRD SEM**	1. **Optical band gap increases with increasing dose** 2. **α-phase changes into a mixture of β and γ-phases** 3. **crystallite size shows oscillatory behaviour with dose** 4. **Cloudy type feature with micro voids appears at highest dose.**
PMMA	**125 μm**	**0, 48, 110, 142, 174 and 300 kGy**	**UV-VIS FTIR XRD SEM**	1. **Band gap shows oscillatory behaviour with dose** 2. **transmittance intensities also show oscillatory behavior without causing significant changes in peak positions** 3. **Recovery characteristics in XRD patterns is observed** 4. **Formation of granular network structure at lower doses and voids formation are seen at higher doses.**
UHMWPE	**500 μm**	**0, 16, 110 and 300 kGy**	**UV-VIS FTIR XRD SEM**	1. **Band gap decreases by 32% and crystallite size increases by 35% at highest dose.** 2. **Transmittance intensities show oscillatory behaviour** 3. **No significant change is found in XRD patterns** **Rocky surface turns into cloudy type feature with increased number of micro voids.**