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Title of the Thesis:

"STUDIES ON RADIATION GRAFT MODIFICATION OF POLYPROPYLENE AND DEVELOPMENT OF PP BASED NANO-COMPOSITES"

ABSTRACT

The overall objective of the thesis is to develop a new polymeric material through functionalization of polymer by grafting followed by the use of this grafted polymer as compatibilizer for the development of nanocomposites. The systems chosen for this study are Polypropylene (PP), Glycidyl methacrylate (GMA) and Montmorillonite nanoclay (Cloisite 30B).

Influence of the Swift Heavy Ion Radiation on Structural and Chemical Changes in Biaxially-Oriented Polypropylene (BOPP) film. Swift heavy ions (SHI's) are the heavy ions with kinetic energies of the order of 1 MeV per nucleon. FTIR studies provide information about the formation of branches, increase in conformational order and the reduction of isotactic helical structure of PP with increase in fluence of swift Si ions. UV–VIS

studies have given information about the unsaturated groups like dienes and trienes occurred after the irradiation at high fluences. It has been further observed that Ag ions ($\Phi \leq 3x10^{11}$ ions / cm^2) are preferable for generating the PP macroradicals and hydroperoxides needed for graft modification of polypropylene.

Functionalization through Glycidyl methacrylate Grafting of Industrial Polypropylene Films using Swift Silver ions. Using a commercial BOPP film, we grafted glycidyl methacrylate monomer using swift Ag^{9+} ions. The polymorphic transitions α to β of PP occurred at higher grafting yields. The evolution of average crystallite size was explained in terms of effect of the length of graft chains as well as double and triple bonds on the crystallization process.

The Effect of Chemical Initiator on the Synthesis of Functional Polymers by Grafting of Glycidyl Methacrylate onto Swift-Heavy-Ions Irradiated BOPP Films. Exposure of industrial PP film to SHI results in reduction in the effect of the BPO for graft copolymerization. The hydrophilicity of PP film was substantially improved by introducing the GMA polar groups to the polymeric chains. The surface energy of PP–g–GMA copolymer increased significantly with the rise of the grafted GMA concentration in the copolymer.

The Development of PP/Cloisite 30B Nanocomposites. Polypropylene–commercial montmorillonite organophilic clay nanocomposites were developed in a co–rotating twin–screw extruder using polymer melt–direct intercalation or exfoliation approach. The obtained results suggest that PP/Cloisite 30B nanocomposites with improved mechanical properties can be prepared via simple one step, direct twin screw extrusion compounding.