

RADIATION MODIFICATION OF SOME POLYMERIC MATERIALS BY GRAFT POLYMERIZATION

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Radiation Modification of Some Polymeric Materials by Graft Polymerization

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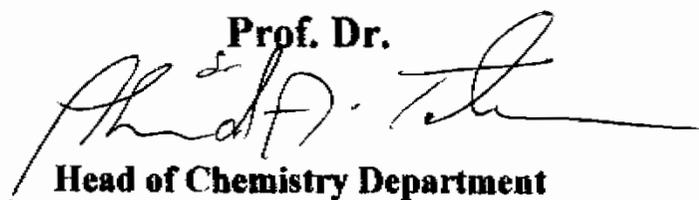
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TO MY PARENT

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" NOTE "

Besides the work carried out in this thesis , the candidtae has attended postgraduate courses in the following topics : -

- 1- Photochemistry .**
- 2- Instrumental Analysis .**
- 3- Polymer Chemistry .**
- 4- Quantum Chemistry .**
- 5- Spectroscopy .**
- 6- Chemical Kinetics and Catalysis .**
- 7- Thermodynamics .**
- 8- Surface Chemistry .**
- 9- Advanced Electrochemistry .**
- 10- Advanced Reaction Mechanism .**
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ABSTRACT

The radiation - induced graft copolymerization of vinyl acetate (VAc) and N-vinylpyrrolidone (NVP) onto polypropylene (PP) and (tetrafluoro-ethylene-hexafluoropropylene) copolymer (FEP) , individually and in a binary mixture for the preparation of synthetic membranes was studied . The influence of reaction conditions on the grafting yield was determined . Characterization and some properties of the prepared grafted materials were also studied by measuring the change in their thermal parameters (T_g , T_m , ΔH_m , ΔH_{rc}). The swelling behaviour , gel determination and electrical conductivity and possibility of the practical uses of the modified graft copolymer were also investigated .

AIM OF WORK

Radiation initiated grafting is a very broad field which has attracted considerable interest over the last two decades . Graft copolymers are alloys of polymers which , at least in principle , may combine the desirable properties of two polymeric components . Radiation methods are particularly suited for the production of a large variety of graft copolymers having interesting properties .

The modification of properties of polymeric materials by radiation grafting of suitable monomers is well known . The technique has largely been restricted to grafting of a single monomer , but grafting from a binary mixture (comonomer) may well be more beneficial because a very large spread in properties might be incorporated in the polymer .

In this study , the preparation and some selective properties of graft copolymers obtained by radiation grafting of vinylpyrrolidone and vinyl acetate (individually) onto polypropylene (PP) and poly (tetrafluoro-ethylene-hexafluoropropylene) copolymer (FEP) films were investigated . The influence of grafting conditions such as solvent , solvent mixture composition , irradiation dose , type of inhibitor , monomer concentration , on the grafting yield and on the properties of the obtained graft copolymers was studied . Swelling , electrical and thermal properties were also investigated . A trail has been made also on the graft polymerization of comonomer such as vinyl acetate and vinyl pyrrolidone onto PP and FEP films . The effect of comonomer composition and comonomer concentration on the grafting yield and on the properties of obtained graft copolymer was studied .

INTRODUCTION

Where -A-A- is the original polymer chain and -B-B- the chains produced from the added monomer. This process of graft polymerization is useful since it enables polymers with new properties to be built up.

There are several ways of producing the graft polymer⁽¹⁾. The simplest is merely to immerse the polymer in the monomer so that it will absorb as much as possible, and then irradiate the swollen polymer. This has the disadvantage that the amount of monomer that can be absorbed by the polymer is limited, and also that the monomer may form chains that are not attached to the original polymer chain. If the radical sites are relatively stable, the polymer can be irradiated and then immersed in the monomer. By using radiations which have a limited penetrating power ⁽²⁾ (e.g. x-rays of low energy) the radical sites can be limited to the surface of the polymer, giving a graft polymer in which the second polymer forms a layer on the surface of the original material. Yet another approach that can be used in some cases is to irradiate the first polymer in the presence of air, so that peroxide are formed, immerse it in the monomer, and heat the mixture so that the peroxides are decomposed and form radical sites onto which the monomer grafts. Radiation initiate the polymerization of monomers, graft and block copolymerization, and also causes crosslinking and degradation in polymers. Many monomers have been polymerized by radiation when polymer are irradiated, radicals are formed that can react with monomer to produce graft copolymer.