

Name of the candidate: G. B. V. S. Lakshmi  
Name of the supervisor: Prof. M. Zulfequar  
Name of the co-supervisor: Dr. A. M. Siddiqui  
Department: Physics  
Thesis title: "Effects of Swift Heavy Ion irradiation on conjugated Polymers"

### Abstract of thesis

The present thesis lays emphasis on the "*Effects of Swift Heavy Ion irradiation on conjugated Polymers*".

The derivatives of polyaniline and polythiophene semiconducting polymer powders are synthesized by chemical oxidation polymerization method, are doped and self supporting films are prepared by blending. Polythiophene derivatives are dissolved in chloroform and thin films are prepared on glass and Si substrates. Polyaniline and poly(3-methyl thiophene) thin films were prepared on glass and Si substrates by rf-plasma polymerization method and characterized. All the films are irradiated by various Swift Heavy Ion beams at Inter University Accelerator Centre, New Delhi. The effects of SHI irradiation have been studied by characterizing the pre and post irradiated polymer films using FTIR, XRD, UV-Visible studies, PL and dc-conductivity studies.

The first chapter of this thesis serves as an introduction and in second chapter the experimental techniques are discussed, which include mainly the chemical synthesis of conducting polymers used in the present study, characterization techniques such as FTIR, XRD, UV-visible and DC-conductivity studies and irradiation facility at IUAC with RGA facility. The chemical oxidation polymerization of Polyaniline, Poly(o-toluidine) and poly(m-toluidine) follow the same path whereas the chemical polymerization method of Poly(3-methylthiophene) differs from the others. The doping and blending of poly(o/m-toluidine) are also discussed in brief.

The results are summarized as follows:

**Effects of SHI irradiation and RGA studies on poly(o-toluidine)-PVC and poly(m-toluidine)-PVC blends** are explained in third chapter. The effects of doping on poly(o/m-toluidine) powders and poly(o/m-toluidine)-PVC blend films. Then the effects of SHI irradiation of 60MeV C<sup>5+</sup> and 60MeV Si<sup>5+</sup> ion beams on the self supporting blend films are discussed in detail. RGA studies play an important role in understanding the

physico-chemical changes occurring in polymers due to irradiation. The RGA studies on PoT-PVC and PmT-PVC blend films with irradiation of 60MeV Si<sup>5+</sup> ions are also discussed in this chapter.

**Effects of SHI irradiation and RGA studies on polythiophene derivatives** are discussed in chapter four. Poly(3-methylthiophene) has been prepared by chemical polymerization method in the laboratory and poly(3-octylthiophene) has been procured from Alfa-Aesar company. Both the powders are dissolved in chloroform and films prepared on glass and Si substrates by spin coating method. The details of irradiation effects of 60MeV C<sup>5+</sup> and 60MeV Si<sup>5+</sup> ion beams are discussed in this chapter. The RGA studies on p3ot are also discussed in this chapter.

**Plasma polymerization, characterization and SHI irradiation on polyaniline and poly(3-methylthiophene) thin films** are discussed in chapter five. This contains the preparation of conducting polymer thin films by rf-plasma polymerization method. Plasma polymerization is a novel technique to prepare polymer thin films of desired thickness. Polyaniline and poly(3-methylthiophene) thin films of about 200 nm thickness films have been prepared by rf-plasma polymerization. The characterization and effects of irradiation on these films are discussed in detail in this chapter.

Chapter six gives the conclusions of the present work and future prospects.