CHAPTER - 1

INTRODUCTION

The polymers find their applications in all facets of our life because of wide range of the properties and the possibilities of modifying them as per the requirements.

The different physical properties of polymers and their importance in many areas of applications, attracted major attention from several researchers. Among many physical properties, the luminescence properties have their own importance in the study of the different properties of polymers: such as molecular mobility, structure, degradation, structural transition, energy transfer etc.

It is believed that luminescence and thermoluminescence of polymers will play important role in their selection for the applications in the PESC (Photoelectrochemical Solar Cells) and also in dosimetry. The conversion efficiency or yield of PESC cell is less, since most of the solar energy falling on the cell is not utilized for conversion into electrical energy. As part of the incident energy is in the form of heat which is removed by inserting a cell with water. This heat energy thus is a waste: and if it can be somehow used up to create more light energy which in turn can then be converted into electrical energy, the yield will be much higher. Thermoluminescence is the property of a material which converts heat into light. Hence, we use this property of thermoluminescence to convert the wasteful heat into useful light. Therefore, TL has to be studied for its emission in the visible region.

The efficiency of a solar cell is affected, when any luminescent polymer is used. Some work (1-4) has been carried out to increase the efficiency of PESC cell by the use of polymer films as solar collectors and luminescent concentrators. Thus, polymer is needed in the form of a film on synthesis. With the view, some polyesters of coumarin have been synthesized in the laboratory.

In addition to the above the application of luminescence spectroscopy to polymers have been the subject of several reviews (5-9) and books. (10,11) Luminescence is sensitive to chemical structure & geometry of the molecules. It is essential to know the effects of structure and the enviornment on the emission process, while studying luminescence. Luminescence can provide information on the effect of thermal and/or mechanical treatments, characterization and structural elucidation of molecules. The study of emission provides the information on excited states of the molecule and on the mechanism of energy transfer between molecules or among different states of the same molecule. Thermoluminescence is the visible emission from the TL material when heated at uniform rate. Similar to luminescence, thermoluminescence emission is very sensitive to physical and chemical conditions of materials. The physico-chemical dependant luminescent characteristics make many materials useful in various applications. Thermoluminescence from inorganic materials has been studied for long time. But during last two decades only, similar studies have been made on organic polymers. Little work on the thermoluminescence studied in polymers has been reported. The work is reported on thermoluminescence mostly in polyalkenes. It has been found that thermoluminescence is the most useful method for locating and studying molecular motion, structural transition in polymers. Furthermore, detailed study of thermoluminescenece in polymer gives much more information on the charge diffusion, traps in polymers, impurities, radiation dose etc.

It is found from the present investigation that specimens under study show TL peak around 82° C, without any pretreatment. After the thermal & mechanical treatments, the change in the position as well as in intensity of TL peak is observed. The effect of different doses on TL has also been studied for the potential use of polymer material in dosimetry.

Emission spectra for polymers show the peaks at 410 and 520 nm, while in monomer, it is observed at 430 and 520 nm respectively.

The TL peaks at certain temperatures can be explained on the basis of electron-ion recomibnation model suggested by three groups of authors (12-14) The effect of thermal treatment and mechanical treatment on TL peaks are also explained on the basis of the above model. The fluorescence spectra of the specimens are explained by keeping in view the effect of different substituents and change in the configuration after the treatment.

The monomer M and polymers P1, P2, P3, P4 and P5 chosen for the luminescence & thermoluminescence study are:

1. M 5-7 dihydroxy-4-methyl coumarin.

2. P1 Copolyester of 5-7 dihydroxy-4-methyl coumarin with Maleic acid.

3. P2 Copolyester of 5-7 dihydroxy-4-methyl coumarin with sebacic acid.

4. P3 Copolyester of 5-7 dihydroxy-4-methyl coumarin with Phthalic acid.

5. P4 Copolyester of 5-7 dihydroxy -4- methyl coumarin with Isophthatic acid.

6. P5 Copolyester of 5-7 dihydroxy-4-methyl coumarin with Terephthalic acid.

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