CHAPTER : 4

CONCLUSION

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CONCLUISION

Doped polymer films made by doping technique and conventional blending process exhibited same fluorescence characteristics.

Polymer thin films doped by low molecular weight organic fluorescent material have been prepared by spin coating technique. This technique is simple, quick and low cost when compared with other techniques of film deposition. Polymer thin films can also be made by other approaches such as blending of the fluorescence molecules with side chain or main chain of polymer backbone. However, these approaches are time consuming and costly. Doped polymer films made by doping technique exhibited fluorescence similar with those reported in literature for polymer thin films prepared from conventional blending synthesis.

Pyrene is the potential candidate used in the study whose properties investigated systematically in polystyrene matrix. Both monomer and excimer fluorescence of pyrene were observed and found to depend upon its weight percent in polystyrene matrix as well as on the thickness of the film. A lower wt. % films exhibited monomer fluorescence, however, at higher weight percent an excimer emission is observed. Systematic variation in wt. % of pyrene in matrix has indicated the transition from monomer to excimer. It is interesting to note that monomer and excimer emission have been observed from the same film. The fluorescence properties of pyrene doped polymer films are similar to those reported for pyrene in solution and pyrene LB films.

Pyrene doped PS films are homogeneous and transparent. Crystallinity of the polymer doped pyrene thin films has been evidenced by XRD studies. The results on excitation spectroscopy confirm the orientational molecular ordering of the pyrene in PS films (PS=polystyrene). Molecular ordering is concentration dependent and characterized by different luminescent behaviour. A transition from monomer to excimer emission was seen with variation of thickness of films also. As found in the photo resist and optical storage industry

Perylene doped PS films are homogeneous, transperant and fluoresce in visible light. The structural pronomeric emission have been observed from the films containing lower wt. % of perylene, while those containing higher wt % show structureless band due to aggregate molecules.

Pyrene is known to undergo association with perylene to form green emitting exciplex in the crystalline state. Similar excipix emission have been investigated in the fluorescence studies in polystyrene films doped by pyrene and perylene. The green emitting polymer films would be used for fabrication of electroluminescent diodes.

Naphthalene in PS matrix fluoresce in UV and violet region with maximum emission at 314 nm. The absorption and excitation spectroscopy of naphthalene polymer films indicated that the molecule exists in isolated form and possibility of formation of aggregates even at higher concentration with itself is negligible. The fluorescence spectrum of naphthalene even at higher wt % remained unmodified. The excited pyrene associate with ground state naphthalene and undergo excitation energy relaxation to form an excited bimolecular species. This exciplex deactivates to give emission at 480 nm.

Biphenyl absorption spectrum is exceptional as it is a broad band indicating association in the ground state. However, biphenyl exists an isolated molecule in ground state because absorption spectrum of biphenyl film, biphenyl dilute solution and excitation spectrum are identical. The broad band is due to random orientation of phenyl rings not being in the same plane.

The structured monomeric emission of pyrene was observed from biphenyl containing smaller amount of pyrene. The increase in concentration quenches the monomeric emission with simultaneous shift towards red. The fluorescence spectra of biphenyl containing higher amounts of pyrene is broad and structureless due to formation of exciplex between biphenyl and pyrene. The emission colour of biphenyl luminophors can be tuned from violet to intense blue by controlling the concentration of pyrene. It is worthwhile to note that the intensity of exciplex emission is greater than the intensity of pyrene monomer and excimer emission. The host-guest systems absorb short wave UV radiation and transform into blue visible radiation. Such scintillation process would be of use in high energy radiation detectors.

The fluorescence properties of 9ACA are interesting to the substituent – COOH and vary in solutions in aprotic and protic solvents. The PS films prepared from benzene solution containing 9ACA have shown its weak emission at 412 nm, at lower wt % in film while the PS films containing higher wt % of 9ACA have shown intense broad, structureless band peaking at 468 nm. Films prepared from polyvinyl alcohol solution in ethyl alcohol have shown single sharp band peaking at wavelength 412 nm. The films prepared from alcohol-water solution of 9ACA and PVA, shows structured sharp band peaking at 412 nm in the spectra, when 9ACA wt % is lower in the film. However, the film containing higher wt % of

9ACA shows structured anthracene like emission exactly similar with anthracene solution.

The dual luminescence exhibited by 9ACA molecules dispersed in different polymers is interesting. The colour and intensity of polymer doped by 9ACA could be monitored by selecting properly polymers and solvents to prepare soloutions for film casting. The monomer fluorescences of pyrene has been quenched by 9ACA in PS films prepared from benzene solution. As wt % of 9ACA in film increases, the extent of quenching increases and simultaneously a broad band peaking at 468 nm appears.

Solute-solute interactions studied in the present work are of scientific importance. Pyrene interacts with some solutes as efficient energy donor and in some cases it acted as energy acceptor. Pyrene also undergone association with some solutes to form exciplex characterized by broad, red shifted band. Thus by selecting one solute pyrene and other solute properly to dope in the polystyrene films it is possible to spin cast films on different substrates which are emitting with different colours. Tunning of emission colour and enhancing intensity is also possible by monitoring concentration of other solute and keeping that of pyrene constant to a value corresponding to monomer emission. Higher wt % of pyrene in the film produced pyrene excimer emission, similar to its concentrated solution in an inert solvent. A film system of biphenyl with pyrene in polymer matrix could be useful for plastic scientillator where short wave UV radiation are absorbed by film and visible is emitted which could be detected by a photomultiplier tube.