Conclusion

Doped anthracene luminophors are prepared by microwave heating method, which is found to be more advantageous over to earlier conventional methods;

- Water is used as dielectric which is having ability to transform electromagnetic energy into heat which propagates through materials resulting in uniform heating.
- Charring of materials formed is prevented.
- Frequent stirring of the system is not essential.
- Luminophors obtained by using this method are homogeneous with smaller grain size.
- Microwave heating method is quick, simple and inexpensive.

The X-ray diffraction studies indicated that the luminophors are more fined grained and homogeneous. The incorporation of dopant molecules into the lattice of host molecules creates deformation. With a view to understand the deformation in the crystal the structural parameters such as microstain, dislocation density and stacking fault of the host crystals of anthracene doped by various concentration of dopants were calculated by using X-ray diffraction results. The microstain, dislocation density, stacking fault found to decrease with increase in perylene concentration in anthracene luminophors, while in case of other systems these parameters increases with dopant concentration in anthracene luminophors. The results are explained in the light of lattice structures of dopants used in the studies. Most of the dopants like perylene, 9-vinylanthracene and 9-chloroanthracene are monoclinic and have comparable size with anthracene which is also monoclinic lattice. However tetracene dopant is orthorhombic.

The structural parameters of anthracene are not changing much when dopant concentration are lower while a significant change in structural parameter is observed at higher concentration. Thus in nearly all luminophors of anthracene containing 1×10^{-1} mole of tetracene, 9-VA, 9-CA the decrease in structural parameters is significant. However, in anthracene luminophors having concentration 1×10^{-1} mole perylene, the observed increase in structural parameters is more significant. Because of this the optical properties of perylene doped anthracene are found different than the anthracene luminophors containing other dopants.

The fluorescence properties of perylene doped anthracene in crystalline powder and in solution are different. Though in solution studies excitation energy transfer is significant the exciplex formation is not seen in the form of red shifted structureless band even at higher concentration of perylene. The fluorescence spectra of crystalline anthracene containing different amounts of perylene exhibited quenching of anthracene fluorescence with perylene concentration and appearance of red shifted new emission band due to an exciplex formation between anthracene and perylene. The electronic energy transfer from excited anthracene molecule to ground state molecule is probable because in the doped lattice both the molecules are close enough and critical energy transfer distance estimated using Foster relation is 38.3 A°. Since this value is below the expected value of 50 A° the energy transfer found to be more efficient. A suitable mechanism is proposed and tested experimentally. The kinetics/studies of anthracene emission with respect to perylene concentration fit into Stern-Volmer type relation. The experimental data helped to estimate rate constant of energy transfer and it is of the order of $2.477 \times 10^{11} sec^{-1}$ and is of higher order than reported in solution studies.

Tetracene though it is planer like perylene does not act to form exciplex with anthracene but doped system gives classic donor-acceptor system where excitation energy transfer from excited anthracene to ground state tetracene seems to be more efficient. The presence of tetracene in anthracene lattice quenches anthracene fluorescence and characteristics fluorescence of tetracene appears. Suitable mechanism of EET is suggested and kinetics of EET was explained and tested experimentally by plotting graph of ratio of intensity of tetracene to anthracene against concentration of tetracene. The rate constant for energy transfer was estimated and found to be of the order of $10^9 sec^{-1}$. The solution studies showed that the EET is not probable between excited anthracene and tetracene molecule. The blue emitting anthracene by doping is made to emit in green color. The XRD studies of tetracene doped anthracene indicated that doped luminophors are homogeneous. The dislocation density, stacking fault and microstain found to be decreased with tetracene addition. However, the grain size calculated by using Scherer formula actually increased at higher tetracene concentration in anthracene luminophors.

The 9-vinylanthravcene and 9-chloroanthracene doped anthracene crystalline powders have exhibited nearly identical results in which presence of these molecules in anthracene produced spectral shift. Though the presence of these molecules quenches anthracene fluorescence, the characteristics emission of dopant molecules are not seen like the perylene doped anthracene and tetracene doped anthracene systems. The excitation energy transfer from excited anthracene to these dopant molecules is improbable because of wider separation between anthracene emission and excitation spectra of these dopants. It is believed that presence of polar dopant molecule in anthracene acts in different manner, to produce change in vibronic band intensities. The increase in concentration of polar dopant quenches 0←0 vibronic band of anthracene while nearby 0←1 vibronic band is enhanced. The fluorescence spectrum of anthracene containing higher concentration of dopants (1×10^{-1}mole) shows the wavelength of maximum emission at 446 nm where that of bare crystalline anthracene is 427 nm. The observed spectral shift is because of interaction of polar dopant to produce solid state solvation effect. It is known that closely packed polar solute in the organic molecular solids induces appreciable red shift in the emission spectrum by the local electric field. The observed solid state solvation luminescence is explained on the basis of energy structures both for exciton and for conduction level. The presence of larger amounts of dopant in the anthracene lattice generate strong local electric field which is acting across the excited anthracene molecule and induce changes both in the molecular vibrational energy level and transition dipoles leading to Stark effect. Because of this transition to higher vibrational level are occurred at faster rates than to lower vibrational levels of ground state from lowest vibrational level of first excited singlet state in doped anthracene and intensity of 0←1 band is enhanced.

The structural parameters obtained from powder X-ray diffraction studies showed homogeneity of doped luminophors because XRD profile of doped anthracene is identical with that of bare anthracene except the change in the intensity of diffraction peaks. The intense peak was used to calculate grain size from band broadening and using Scherer formula. The grain size found to be larger for higher dopant concentration. The stacking fault and microstain found to be decreased. This may be because of dopants which are anthracene derivatives belonging to same lattice type and have nearly identical size and

molecular geometry. The displacement of anthracene molecule from its site by dopant does not produce strain or stacking fault in anthracene crystal lattice.

Some important features of present studies

- Synthesis of organoluminophors is economical.
- The microwave heating method developed for preparation of luminophors is simple, quick and gives more homogeneous and intense emitting systems.
- Color tunability is achieved over a wider visible range by controlling composition of the dopants.
- The luminophors prepared in present study provides materials suited for use in EL devices.
- The anthracene-tetracene host guest system absorbs short wave UV radiation and transforms high energy radiation into green visible radiation.
- The perylene, 9-vinylanthracene, 9-chloroanthracene and tetracene used as impurities act as wavelength shifter and indicated their utility in synthesizing luminophors of anthracene emitting at longer wavelength. These intense and red shifted luminophors of anthracene are more economical and can meet the new demands for phosphors required in electroluminescent diodes and in scintillation processes.