Synthesis of Aggregation Induced Emission Enhancement based Low Dimensional Organic materials and their potential use as Sensor

Synopsis

BY

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Synopsis

This thesis entitle **"*Synthesis of Aggregation Induced Emission Enhancement based Low Dimensional Organic materials and their potential use as Sensor*"** contains the work carried out in the Department of Chemistry and Chemical Technology, Midnapore, Paschim Medinipur, Pin-721102, India under the supervision of Prof. Ajay Kumar Misra. This thesis comprises eight chapters.

Chapter I:

Luminogenic materials with aggregation-induced emission enhancement(AIEE) attributes have attracted much interest. In this chapter, recent progress in the area is summarized. Typical examples of AIEE systems and their structure-property relationships are discussed. Technological, especially optoelectronic and biological applications of the AIEE systems are exemplified to illustrate how the novel AIEE effect can be utilized for high-tech innovations.

Chapter II:

This chapter describes various synthetic methods and different stabilization strategies of low dimensional organic particles that have been developed over the years.

Chapter III:

This chapter briefly discuss the characterization techniques of the synthesized low dimensional materials using scanning electron microscopy(SEM), Optical, polarising and fluorescence microscopy analysis, X-ray diffraction(XRD), Single crystal X-ray diffraction, UV-Vis and Fluorescence spectroscopy, Time correlated single photon counting spectroscopy(TCSPC).

Chapter IV:

This chapter describes the theoretical aspects of the computational methodologies used in the present study *i.e.* Semi-empirical method, Hartree-Fock Methods, Density Functional theory (DFT) and Time-dependent Density functional theory (TDDFT), Basis sets and Fukui Parameter etc.

Chapter V:

This chapter presents the synthesis of Bathophenanthroline(BA) microstructures using reprecipitation method. Morphologies of the synthesized particles are characterized using optical microscope and SEM. Aggregated BA shows AIEE effect. It is used for selective detection of trace amount of mercury ion(Hg^{2+}) in water. This strong fluorescence quenching of this in presence of Hg^{2+} ions compare to other metal ions has been explained by ground state complexation between BA and Hg^{2+} ions and external heavy atom induced perturbation by Hg^{2+} ion.

Chapter VI:

This chapter describes the interesting photophysical behavior of 4,4′-bis(diethylamino)benzophenone(BZP) aggregated hydrosol showing exceptionally large blue shifted enhanced emission compare to its solution phase emission which arises from its locally-excited(LE) states with the suppression of twisted intramolecular charge transfer(TICT) motion. This is known as aggregation induced locally excited(AILE) state emission. A broad red shifted emission is observed for larger aggregate from the excited intramolecular charge transfer(ICT) state of planar BZP. Morphology of these particles is studied by SEM and optical microscope. This AILE emission is quenched in presence of glucose by forming hydrogen bond between glucose and BZP molecule and is responsible for crystal softening. Thus sense Glucose at low concentration.

Chapter VII:

This chapter describes a heteroatom containing organic fluorophore 6,7-dimethyl-2,3-bis-(2-pyridyl)-quinoxaline(BPQ) which exhibit AIEE phenomena by restricting intramolecular rotation. It allows reversible fluorescence switching in basic and acidic medium by changing emission color from blue to green in aggregated state through protonation because there is a competition between ICT and the AIEE phenomena at lower pH range(pH~1-4). Morphologies of the particles are characterized using optical microscope and SEM. The turn off fluorescence property has been utilized for selective detection of picric acid and this is explained due to ground state complexation.

Chapter VIII:

This chapter presents a novel material showing AIEE which is synthesized by reprecipitation method using 2,2′ biquinoline(BQN). Morphologies of the particles are characterized using optical microscope and SEM. The selective fluorescence and absorbance response of aggregated BQN towards Zn^{2+} and H^{+} is due to ground state complexation and protonation of BQN respectively. Protonation exhibits charge transfer character in transoid form with yellowish green emission but in BQN-Zn^{2+} complex, BQN changes to cis planer conformation and displays considerable intra ligand charge transfer(ILCT) character with sky blue colour under UV excitation. A 2:1 BQN-Zn^{2+} complex have been confirmed using Job's plot.