STIMULI RESPONSIVE FLUORESCENT MATERIALS (Index No.: 63/20/Chem./27)

Abstract

The work in this thesis is five folds consisting of an introduction cum literature survey chapter and four chapters based on my Ph.D. work. In the first chapter we studied the Aggregation induced emission (AIE) and mechanochromic properties of newly synthesized donor-acceptor (D-A) type molecules abbreviated as **1CF$_3$** &**1F$_2$**. These structurally simple donor-acceptor (D-A) type cyanostilbene-based molecules were synthesized in one step Knoevenagel condensation reaction that display AIE and fluorescence switching in presence of various stimuli. We demonstrated their application in inkless mechano-writing and vapo-erasing. With the aid of X-ray single crystal structure and other analytical techniques, we have investigated the mechanism of stimuli-responsive behaviour and their structure function correlation.

In the second chapter, a diphenylamine-acylhydrazone based derivatives namely **DPAHydZOH** was synthesized which exhibit remarkable multi-stimuli responsive properties, encompassing mechanochromic luminescence (MCL), thermochromic luminescence, and photomechanical effects in presence of external stimulus like mechanical stress and light. Such materials that respond to multiple stimuli are incredibly important for developing advanced technologies like strain sensors, photo sensors, and actuators.

The third chapter focusses on photo-switchable solid fluorescent materials, a phenomenon in which the luminescence properties of the solid crystal or films can be tuned using light of specific wavelength. Compared to other stimuli-switching materials, photo-switching fluorophores are comparatively rare and thus need special attention to be explored in much detail. With this aim, we have synthesized two new cyanovinyl-based molecules named as **ArF$_2$** and **ArCF$_3$**, show diametrically opposite photo-switching behavior in their solid state due to substitutional effect. By simply changing the substitution from **-F** to **-CF$_3$**, we can achieve completely opposite luminescence switching behaviour in the solid state. Such smart optical switching materials have immense potential in optoelectronics and other technological applications.

The content of the last chapter (4) is slightly different compared to the previous chapters. In this chapter, we introduce a novel class of D-A type acylhydrazone derivatives named as **NMe$_2$OH**, **NEt$_2$OH-FL** & **NFL** that display thermos-responsive actuation (Thermosalient effect) due to thermal phase transition and fluorescence modulation using polymorphism and substitutional effect. We have demonstrated that polymorphism and alkyl group substitution can be used as an efficient tool for manipulating both thermal actuation and optical property.

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