

# Ultraviolet Light Effect on the Luminescent Lanthanide Complexes

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**Abstract**— Non-fluorinated  $\beta$ -diketone (acetylacetone) and heterocyclic amine (pyrazines) were used to synthesize the lanthanide complexes of the eight-coordination number. The synthesized complexes were characterized by TGA/DTA, <sup>1</sup>H NMR, UV/Vis and their photoluminescence and their Photostability is also investigated. The doping of the synthesized complexes in PVA polymer was also carried out, its photoluminescent properties was also obtainable and its photostability is also reported, making them favourable candidates for PLEDs and Laser studies are also carried out.

**Keywords:** Lanthanides, Paramagnetic NMR, photoluminescence, absorption, energy level.

## I. INTRODUCTION

Lanthanide complexes have been widely investigated over the past many decades because of the unique optical and magnetic properties of the lanthanide ions.[1, 2] The trivalent lanthanides constitute a series of hard Lewis acids with a similar chemical behavior. Strategies for the design of stable trivalent lanthanide complexes relies on the use of various ligands such as polyaminopolycarboxylates,[3] cryptands,[4] calixarenes,[5] podands,[6] helicates[7] and among others the complexes with  $\beta$ -diketones [8] are the most popular and intensively studied lanthanide complexes. The tris( $\beta$ -diketonate) lanthanide complexes possess significant thermodynamic stability and higher volatility.[9] The tris( $\beta$ -diketonate) lanthanide complexes are coordinatively unsaturated and usually remain solvated. The solvent molecule can be replaced by one or two additional ligands that act as Lewis bases, and form adducts with tris( $\beta$ -diketonate) complexes because of the tendency of the rare-earth ion to expand its coordination sphere.[8] The Lewis bases that form adducts with rare-earth tris( $\beta$ -diketonates) are mostly N, N-donor ligands such as 2, 2'-bipyrimidine,[10-12] 2, 2'-bipyridyl,[13, 14] 2, 2', 6', 2''-terpyridyl,[15] bathophenanthroline,[16] 2-(2-pyridyl)benzimidazole [17] etc. The simplest of non-chelating heterocyclic ammine is pyrazine which can be employed to synthesize mononuclear[18] or dinuclear complexes.[19, 20] The <sup>1</sup>H NMR represents a fruitful technique in determining the structure of lanthanide complexes. The most members of the series are paramagnetic (with the exception of La(III) and Lu(III)) with short electron relaxation times (10<sup>-4</sup> s) and some of these have been tested as shift reagents.[21] In 1969 lanthanide induced shift reagent was first reported by Hinckley in simplifying the unresolved <sup>1</sup>H NMR resonances

in low field NMR spectra of organic molecules in non-aqueous solvent.[22] It was a major advance in the field of shift reagents and since then it has been established that Ln(III) complexes result in far less line width broadening and generate shifts which are predominantly pseudocontact in nature.[23] In this paper we report trivalent lanthanide complexes and main focus of our study is on UV effects on samples.

## UV Effects

To study the effect of UV radiation on the samples of bare complex and the complexes embedded in PVA matrix. The normalized integrated intensity of the intra-configurational transitions of pure complex and their respective thin hybrid films were monitored under the continuous irradiation of UV dosage of different wavelength excitations as a function of time. Upon UVA dosage the normalized intensity of the integrated hypersensitive transitions of both the complexes decreases continuously with time. It seems that photo-bleaching (photo-degradation) or UV instability occurs that restricted their use in device applications, while as in case of thin hybrid films of the respective complexes upon exposure to the same wavelength shows observable resistance to this UV-unstability, thus photo-bleaching of the hybrid complexes is prevented. It indicates that some sort of UV fatigue or simply photostability behaviour was observed. The decrease in the normalized intensity of the bare complexes with time could be due to the energy loss by the ligands vibrations usually  $\beta$ -diketonates associated with it. The important results achieved in this study shows that the emission properties of the complexes in the polymer host showed enhanced effect and are quite stable under continuous exposure of UV light, hence acts as UV protector for Ln(III) complexes..

## II. REFERENCES

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