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NIR emission and energy transfer phenomena in $\text{Bi}_2(\text{MoO}_4)_3$ doped with Nd^{3+} and/or Yb^{3+}

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Synthesis and Photoluminescence Study of Ce^{3+} doped CaAl_2S_4 Phosphor

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Abstract— The synthesis method and photoluminescence properties of Ce^{3+} doped CaAl_2S_4 phosphors for white light emitting diode (LEDs) are reported. Conventionally, thioaluminates (CaAl_2S_4) were prepared by solid state reaction and the evacuated sealed quartz ampoule. Oh et al. [1] prepared CaAl_2S_4 single crystals by a chemical transport reaction method in a closed system using high-purity iodine as a transport agent. These methods are rather tedious, and require special apparatus. We have described a wet chemical co-precipitation procedure for synthesizing Ce^{3+} activated phosphors with strong excitation in nUV region.

This method does not require the H_2S gas flow during synthesis. We successfully prepared $\text{CaAl}_2\text{S}_4:\text{Ce}^{3+}$ powders by this method. Synthesis and photoluminescence characterization of this phosphors are described in this paper.

Keywords--Photoluminescence CaAl_2S_4 phosphors, near-UV LED phosphors, Ce^{3+} activator.

I. INTRODUCTION

Much attention has previously been focused on the preparation method and fundamental information of CaAl_2S_4 . Different methods are used for the preparation of CaAl_2S_4 thioaluminate. Le Thi et al [2] prepared thioaluminates powder in silica tubes sealed under vacuum by using alkaline earth sulphides, EuS and Al_2S_3 as a starting materials. Yu et al [3] prepared CaAl_2S_4 phosphors doped with Eu^{2+} and Ce^{3+} by using conventional solid state reaction. Many practical applications have been discussed in the field of optoelectronics devices such as field emission display (FED) and phosphor converted white light emitting diodes (pc-WLED). A conventional method used for the preparation of thioaluminates requires special apparatus and H_2S gas flow during synthesis. Hence we used soft chemical process for the preparation of thioaluminates phosphor. We prepared $\text{CaAl}_2\text{S}_4:\text{Ce}^{3+}$ by using this method successfully. Synthesis and characterization of this phosphor are described in this paper.

II. EXPERIMENTAL

The wet chemical co-precipitation method is used to prepared Cerium doped CaAl_2S_4 phosphor. Calcium chloride, Aluminium chloride, sulphur and hydrazine hydrate are used as starting materials. In this method sulphur is dissolved in aqueous solution of hydrazine hydrate (solution 1). An excess of hydrazine hydrate is used with 2:1 ratio of hydrazine hydrate to sulphur. The stoichiometric amount of calcium chloride is dissolved in water in one beaker. The stoichiometric amount of aluminum chloride is dissolved in water in another beaker. This solution is mixed with solution 1. The

Photoluminescence characterization of some Vanadate based phosphors

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Abstract. Highly efficient new vanadate phosphor $A_2NaMg_2V_3O_{12}$ (A= Ba & Sr) doped with rare earth element Dysprosium (Dy) was synthesized at high temperature via solid-state method successfully and the formed compound was confirmed by X-ray diffraction method. Photoluminescence measurements revealed that $Sr_2NaMg_2V_3O_{12}$ phosphor doped with Dy is excited by near ultraviolet light ranging from 300 nm to 380 nm efficiently in order to realize the emission in visible spectrum (in the range 400 nm –570 nm. $Ba_2NaMg_2V_3O_{12}$: Dy phosphor also showed emission at 569 nm on excitation at 325 nm. Hence this prepared phosphor can find application as a green emitting phosphor in solid state lighting area.

1. Introduction

The vanadate based phosphor doped with rare earth element are studied widely till date because of their ability to emit the variety of colors light owing to high luminescence quantum yield that are due to the f-f transition [1–8]. Out of these $YVO_4:Eu^{3+}$ and $GdVO_4:Eu^{3+}$ phosphors (red phosphor) have been center of attraction due to various properties such as good chemical stability, thermal properties and high photoluminescence quantum yield. This makes these phosphors applicable in the field of color TVs, field emission displays [9, 10], cathode ray tubes [11], light emitting diodes [12] and plasma display panels [13, 14]. White light generated by combination of UV -LED & appropriate phosphors is mostly desirable. The AlGaIn-based LEDs which are developed in order to operate at the short wavelength region of UV light are possible to tune [15]. The nano particles of vanadate phosphor have been prepared by some researcher for converting UV pump light of III-N semiconductor light emitting diode into the bands of visible wavelength [16]. A vanadate compound $LiZnVO_4$ is used widely employed as a humidity sensor [17, 18]. The interesting properties of this phosphor are related to its luminescence which is due to its tetrahedrally coordinated V^{5+} ions [19]. The VO_4^{3-} complex ion group wherein centrally located vanadium metal ion coordinated with four O^{2-} ions having tetrahedral symmetry has been recognize as a promising and efficient luminescent center as in other similar to that in other scheelite-type compounds [20].

