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Photoluminescence Synthesis & Characterisation of ChloroSulphate NaMg(SO₄)Cl Phosphor at very low concentration of Mn

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Abstract

 Mn^{2+} emission is studied in NaMg(SO₄)Cl phosphor prepared by wet chemical method. The emission spectra shows four peaks at 491nm, 554nm,561nm and 586nm corresponds to ${}^{4}E, {}^{4}T_{2}, {}^{4}A_{1}, {}^{4}T_{1} \rightarrow {}^{6}A_{1}$ of Mn²⁺ transition when monitored at excitation wavelength of 371 nm. It is use in scintillation applications.

Keywords: Wet chemical method, XRD, PL

1. INTRODUCTION

The Sulfates are an important mineral class and include some very interesting and attractive specimens. We have reported some fluoride and chloride based materials as These halosulphates, phosphors [1]. KZnSO₄Cl:Ce, Dy and KMgSO₄Cl:Ce,Dy; KMgSO₄Cl:Eu; NaMgSO₄Cl:Ce have been reported as phosphors by wet chemical, solid state diffusion melting route and characterized XRD, photoluminescence (PL), thermoluminescence (TL). Therefore, it is considered to develop the halosulphate based material such as $NaMg(SO_4)Cl$.

2. EXPERIMENTAL

For the preparation of NaMg(SO₄)Cl (pure); NaMg(SO₄)Cl:Mn by wet chemical method, the constituents of AR were taken in a stoichimetric ratio and dissolved separately in double distilled de-ionized water, resulting in a solution of NaMg(SO₄)Cl. Water soluble Chlorine salt of manganese was then added to the solution to obtain NaMg(SO₄)Cl:Mn. Confirming that no undissolved constituents were left behind, and all the salts had completely dissolved in water and thus reacted as, MgSO₄ + NaCl \rightarrow NaMgSO₄Cl.

The compounds in its powder form were obtained by evaporating on 80 °c for 8 hours. The resultant polycrystalline mass was crushed to fine particle in a crucible. The powder sample was then characterized for x-ray

diffraction (XRD) and photoluminescence (PL) study.

3. RESULTS AND DISCUSSIONS

The XRD peaks of the present host were matched with the standard JCPDS. The excitation spectra consists of one band at 371 nm due to the ${}^{4}T_{1} \rightarrow {}^{6}A_{1}$ transition of Mn²⁺ when monitored at 554 nm emission wavelength. Emission spectrum consists of four peaks at 491nm, 554nm,561nm and 586nm that is correlated with ${}^{4}E, {}^{4}T_{2}, {}^{4}A_{1}, {}^{4}T_{1} \rightarrow$ ⁶A₁ electronic transitions in the activator Mn ions. In the emission spectra of $NaMg(SO_4)Cl$ phosphor characteristic UV emission peaks corresponds to the Mn²⁺ intra transitions from the excited levels to lower levels. The emission peaks are located at 554 nm and 561 nm which falls in UV region of spectrum at very low concentration of Mn typical transitions in the host lattice.

CONCLUSIONS

The host $NaMg(SO_4)Cl$ is suitable for the emission of Mn at very low concentration level and could be a good candidate for scintillating phosphor.

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References



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Fig 2 : Excitation Spectra of $NaMg(SO_4)Cl$:Mn at 371 nm



Fig 3 : Emission Spectra of NaMg(SO₄)Cl :Mn at very low concentrations of Mn

(a) 1 (b) 0.5 (c) 0.2 (d) 0.05 (e) 0.02 mole% .



