SYNTHESIS OF $MgAl_2O_4$ USING COMBUSTION TECHNIQUE

Pankaj Pathak, Manisha Singh, Pankaj Mishra

Department of Physics,
Amity School of Pure and Applied Sciences, AUMP, Gwalior

Abstract : The Synthesis of Pure and Dysprosium (Dy) doped Magnesium Aluminates (MgAl2O4) using combustion technique has been reported in the present paper. The Urea Nitrate was used as a fuel for synthesis of $MgAl_2O_4$. X-ray diffraction (XRD) of the prepared material was recorded in a range of 20–80° of Bragg angle 2θ using a Bruker D2 phaser X-ray diffractometer with Cu target (λ = 0.154 nm). XRD confirms the structural and phase purity of prepared sample.

***IndexTerms* – Combustion technique, Aluminate**

I. INTRODUCTION

The Aluminate based alkaline earth phosphors are reported to show good chemical stability and emission in visible region [1-4]. The alkaline earth aluminates when doped with trivalent rare earth are specifically studied because of their remarkable luminescent characteristics, which can be extensively used for applications in solid state lightning devices, photovoltaic applications, display technology dosimetric applications etc. Magnesium aluminate compound is reported as potential candidate for applications in sensor technology, display devices, paint industry, picture tube applications, luminescent devices. It consists of MgO and Al_2O_3 and with the chemical formula AB_2O_4 and cubic structure. When doped with rare-earth metal ions luminescence efficiency of $MgAl_2O_4$ is reported to increase [5]. Luminescent properties of material are highly dependent on grain size, homogeneity of powder which in turn depends on synthesis technique [1-5]. The combustion technique can be an efficient option taking in view the end results. The end products of it are reported to be pure and homogeneous with particle grain size in nano-range. Also in comparison to solid state reaction ,combustion technique is characterised to have lower processing temperature and time.

The present paper reports the synthesis of Magnesium Aluminate pure and doped. Results of the X-ray diffraction $MgAl_2O_4$, $MgAl_2O_4$: Dy^{3+} phosphors have been analysed.

2. Experimental

For the synthesis of Pure $MgAl_2O_4$ by combustion technique urea NH2CONH2 was used as a fuel, the starting materials Magnesium Nitrate [Mg (NO3)3], Aluminium Nitrate [Al (NO3)3] were taken in stoichiometric ratio and mixed thoroughly in agate pastle and mortar for one hour to form a thick paste. Consecutively the paste was taken in to a crucible which was then kept in a muffle furnace set at 500°C. Within the furnance an exothermic reaction with escape of large amounts of gases (i.e nitrogen, ammonia and oxides of carbon) occurred. This resulted in dehydration of mixture, there-by producing voluminous white foamy ash. The product was then grounded to form powder of precursor, $MgAl_2O_4$, $MgAl_2O_4$: Dy.[6-7]

3. Results

The structural characterisation was made by X-ray diffraction (XRD) of the grounded powder precursor. XRD was recorded in a range of 20–80° of Bragg angle 2θ using a X-ray diffractometer with Cu target (λ = 0.154 nm). Fig.1 depicts the XRD pattern of the Pure $MgAl_2O_4$ and doped $MgAl_2O_4$:Dy^{3+} powder. The diffraction peaks observed for prepared phosphor are in complete agreement with those of JCPDS Card No. 21-1152 as shown in Fig.1. The crystal structure was obtained by powder X-ray diffraction analysis. The XRD analysis discovered that the suitable introduction of an dopand (Dy3+) did not influence the crystal structure of the host matrix, including that Mg2+ ions can be to some extent replaced by Dy3+ ions without any change in crystal structure[6]. Further analysis of XRD data showed absence of any impurity, thereby indicating formation of a pure crystalline structure of MgAl2O4. With increase in concentration of dopand Dy3+ ,no shifting of the diffraction peaks was observed, as variation in dimensions of unit cell resulting on addition of dopand is not within detection range of the available XRD technique

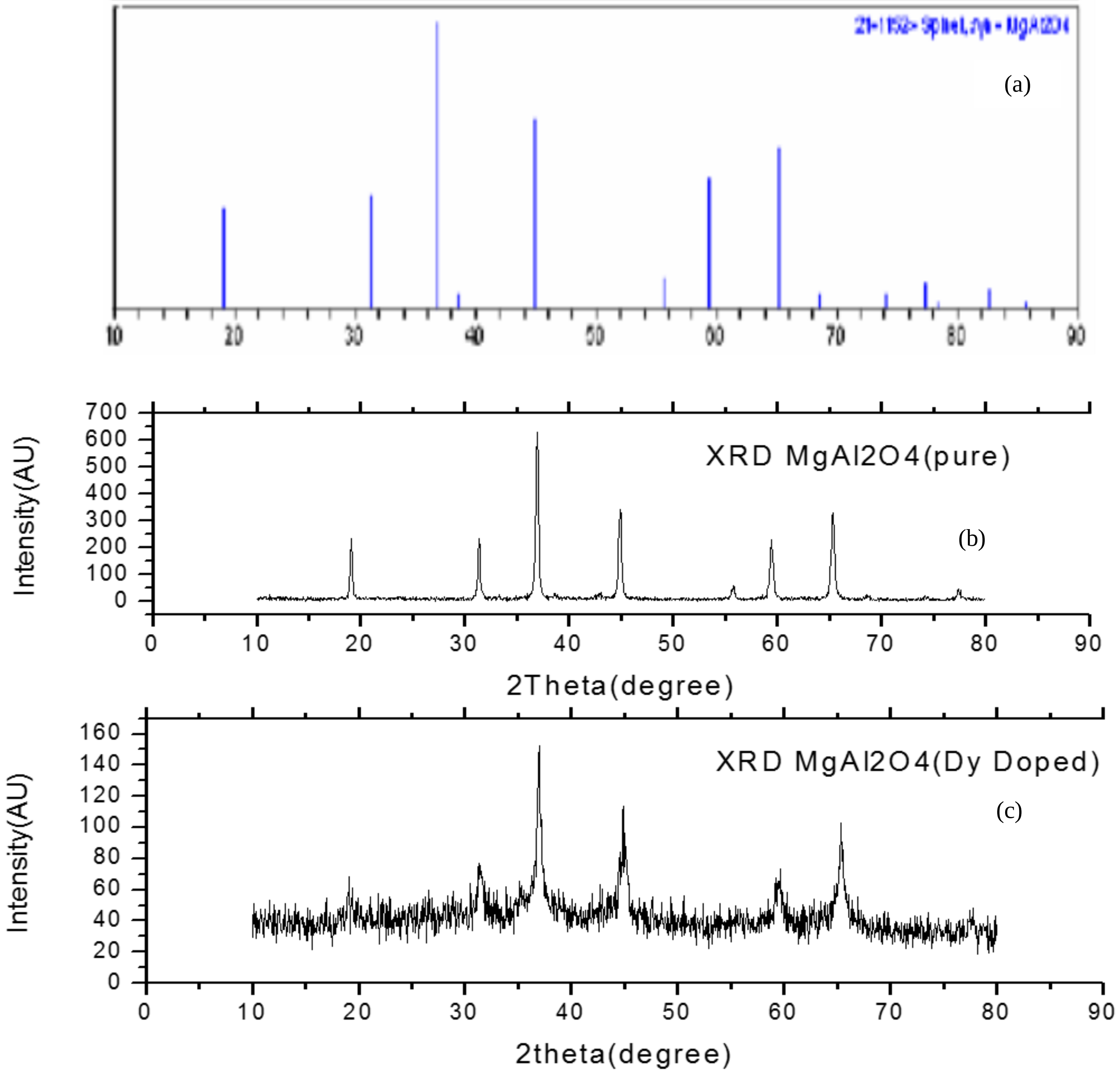

Fig. 1. Reference XRD Pattern of $MgAl_2O_4$(JCPDS card No 21-1152) (b) XRD pattern of $MgAl_2O_4$(Pure) and (c) XRD pattern of $MgAl_2O_4$:Dy

4.Conclusion

We concluded from this study that the combustion technique offers better purity and homogeneity, fast, cost effective and precise method for synthesis of Aluminates.

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