

Investigation of the Luminescence Properties of Sr_2CeO_4 Phosphors in the Vacuum Ultraviolet Region

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The research for oxide-based phosphors has been increasing due to their applications in many fields, such as cathode ray tubes (CRTs), light-emitting diodes (LEDs) and field emission displays (FEDs). Oxide-based phosphors attract researcher's attention due to the advantages of their good stability upon excitation by electron beam. For FEDs application, red and green phosphors have been commercially used. However, comparable blue emitting phosphors are still few.

Danielson et al. have reported a novel blue phosphor Sr_2CeO_4 prepared via the combinatorial material synthesis technique [1]. Sr_2CeO_4 , exhibiting the emission peak at ~ 480 nm upon the excitation at ~ 280 nm, is considered as a potential blue emitting phosphor. Some synthetic routes have been applied to prepare Sr_2CeO_4 phosphors, including the traditional solid-state process [2], co-precipitations [3], ultrasonic spray pyrolysis [4], and pulsed-laser depositions [5]. However, the high temperature and long reaction time are required for these reported methods. The sol-gel method, possessing advantages of well controlling the stoichiometry, particle size and morphology, is a potential method for preparing inorganic materials. In this study, the sol-gel method was utilized for preparing Sr_2CeO_4 phosphors. Citric acid and ethylene glycol were used as the chelating and polymerizing agents, respectively. The resulting precursors were heated at different temperatures for 4 h.

In order to understand the photoluminescence properties of Sr_2CeO_4 phosphors, vacuum ultraviolet excited luminescence studies were carried out using the synchrotron radiation facility (BL-03A1) at National Synchrotron Radiation Research Center (NSRRC), Taiwan.

The optical characteristics in VUV region reflect the intrinsic properties of the luminescent materials. However, the VUV excited luminescence of Sr_2CeO_4 phosphors has not been reported in literature. In this study, the emission spectra monitored at 193 nm for Sr_2CeO_4 powders heated at different temperatures were investigated. As shown in Fig. 1, for all samples, broad emission spectra peaking at 474 nm were observed. As the heating temperature increased from 800 to 1100°C, the emission intensity was greatly enhanced and reached a maximum. After further increasing the temperature to 1200°C, the emission intensity of the sample was reduced. The excitation spectra in VUV and UV region monitored at 474 nm are illustrated in the inset of Fig. 1. One excitation band at around 193 nm in VUV region was

also observed. This band could be assigned to the charge transfer transition between Sr^{2+} and O^{2-} , referring to the absorption of the host.

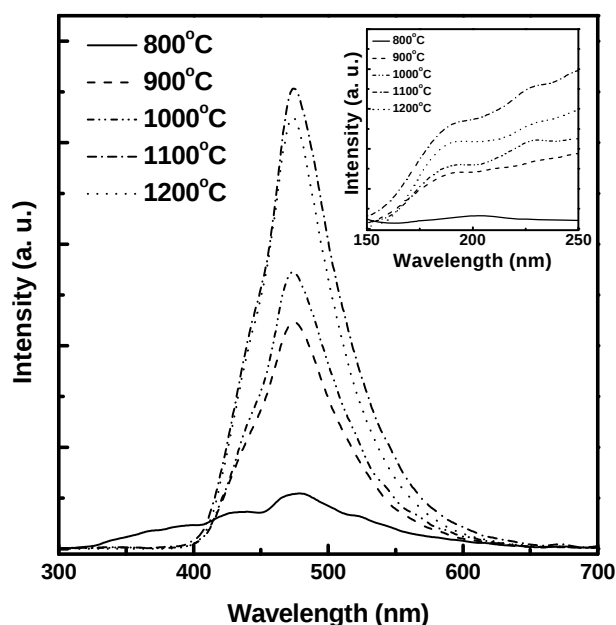


Fig. 1: VUV-excited emission and VUV excitation (inset) spectra of the precursors of Sr_2CeO_4 prepared via the microwave-assisted solvothermal process and heated at various temperatures for 4 h.

References

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