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VUV photoluminescence properties of $\text{KSrPO}_4\text{:Dy}^{3+}$ phosphorYali Chen ^{a,b}, Jingyan Fan ^{a,b}, Yajun Zhou ^{a,b,*}, Jing Gou ^{a,b,*}, Binxun Yu ^{a,c}^a Key Laboratory of Applied Surface and Colloid Chemistry, Ministry of Education, Shaanxi Normal University, Xi'an 710119, China;^b Shaanxi Key Laboratory for Advanced Energy Devices, Shaanxi Engineering Laboratory for Advanced Energy Technology, School of Materials Science and Engineering, Shaanxi Normal University, Xi'an 710119, China;^c School of Chemistry and Chemical Engineering, Shaanxi Normal University, Xi'an 710119, China.**Abstract**

White-light-emitting phosphor based on phosphate host matrix, KSrPO_4 doped with Dy^{3+} , were prepared by solid state reaction and its VUV luminescent properties were firstly investigated. The excitation band peaking at 125–153 nm corresponding to the absorption of PO_4^{3-} group exhibits very strong absorption. The phosphors emit warm-white luminescence under vacuum ultraviolet excitation of 147 nm, which is consisted of three main emission peaks located at 475, 570 and 662 nm, respectively. According to the luminescence and color chromaticity of the optimal sample $\text{KSrPO}_4\text{:1%}\text{Dy}^{3+}\text{,1.3%}\text{Li}^+$, it can be a potential candidate for mercury-free fluorescent lamps.

Keywords: Phosphor, Photoluminescence, VUV; Rare earths**1. Introduction**

The driving forces of the recent developments for lighting are climate change, energy saving, and energy efficiency. There is even political support for alternative solutions in the form of light-bulb bans and climate-saving emissions targets. White-light-emitting diodes (WLEDs), Organic light-emitting diode (OLEDs) and mercury-free fluorescent lamp are all possible candidates. But the present WLED is a point light source that is not the most suitable candidate for lighting. The OLEDs is a flat panel lighting that is suitable for interior lighting, however, it has a limited lifetime for practical application. Therefore there is an increasing demand for white light based mercury-free fluorescent lamp as a flat light source because of their long lifetime, higher energy efficiency, and environmental friendly characteristics [1-4].

Recently, phosphate compounds have emerged as an important family of luminescent materials accommodating rare earth (RE) ions. Their merits are the host absorption edge at rather short wavelengths, excellent thermal stability and the tetrahedral rigid three dimensional matrix of phosphate which is thought to be ideal for charge stabilization [5-7]. Because of the different size of the two cations $\text{A}^\square$ and $\text{B}^\square$, the $\text{A}^\square\text{B}^\square\text{PO}_4$ ($\text{A}^\square$ =monovalent cation and $\text{B}^\square$ =divalent cation) monophosphate family can crystallize as various structure types [8,9]. Adjusting the ABPO_4 family structures can optimize their physical property for developing new useful materials. Another advantage is its nonlinear optical property, which makes them attractive for several important applications on optical technology researches [10]. The current researches about phosphate phosphors are focused on the development of novel host materials to improve the luminescence properties of phosphors, for example, (Eu,Tb,Tm)-doped $\text{AZr}_2(\text{PO}_4)_3$ phosphor and $\text{NaGdFPO}_4\text{:Ln}^{3+}$ are explored as excellent VUV phosphor, Eu^{2+} -activated KSrPO_4 phosphor emitting strong blue light with excellent thermal stabilities, blue phosphate phosphor $\text{LiSrPO}_4\text{:Eu}^{2+}$, red-emitting phosphor $\text{Sr}_8\text{ZnSc}(\text{PO}_4)_7\text{:Eu}^{3+}\text{,Li}^+$, white-emitting phosphor $\text{Sr}_8\text{ZnSc}(\text{PO}_4)_7\text{:Dy}^{3+}$ and white-emitting $\text{Sr}_8\text{CaSc}(\text{PO}_4)_7\text{:Eu}^{2+}\text{,Ce}^{3+}\text{,Mn}^{2+}$ phosphor with tunable color chromaticity [8,13-18]. Hence there is an increasing interest in the investigation of new efficient phosphate materials.

Usually, the white light is obtained by the blend of red, green, and blue-emitting phosphors, and it could exhibit an excellent color rendering. However, this method leads to the increase in manufacturing cost and decrease in

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