

Photoluminescence of Nano Scale Phosphor ($Y_3Al_5O_{12}$: Rare-Earth)

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The fabrication process and photoluminescence properties of nano scale $Y_3Al_5O_{12}$ (YAG) phosphor doped with different rare earth elements were studied. Pure phase nano scale YAG powder was successfully synthesized by co-precipitation method with the addition of hexamethyldisilazane (HMDS)^[1] at temperature significantly lower than that of traditional solid-state reaction. Different YAG particle size ranges from nm to μm were produced by different calcination temperature (700-1000 °C) and were characterized by XRD (Fig. 1), TEM (Fig. 2), and particle size analyzer (Fig. 3). Meanwhile, the optoelectrical properties (Fig. 4), such as quantum efficiency, luminescent intensity and absorption spectrum, were measured by photon excitation to understand the correlation between the particle size and photoluminescence. In general, the luminescent intensity of nano scale YAG phosphor is better than that of micro scale. The quantum efficiency measurement of nano scale YAG shows a Q.E. greater than unity, which is believed to be a multi-photon effect. The detailed mechanism and experimental results will be discussed and presented in this report.

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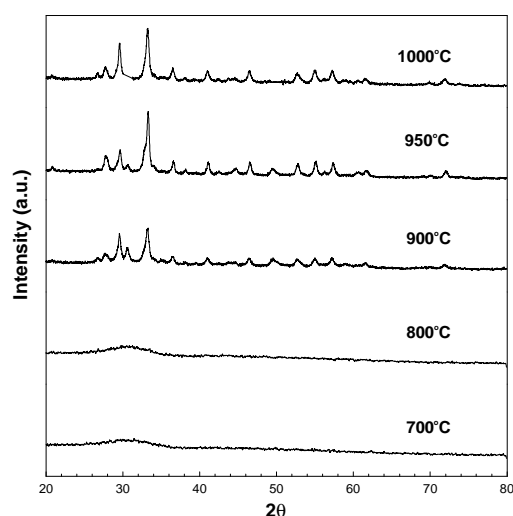


Fig. 1 XRD pattern of $Y_3Al_5O_{12}$:Ce calcinated at various temperatures.

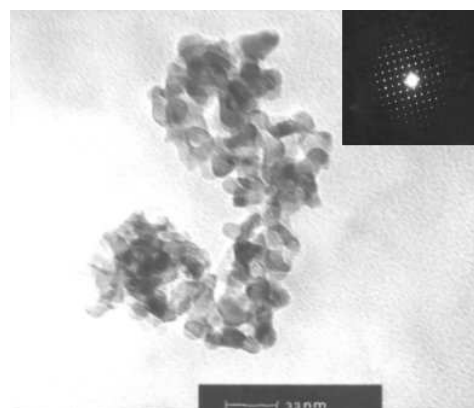


Fig. 2 TEM image and diffraction pattern (inset) of nano-sized $Y_3Al_5O_{12}$:Ce

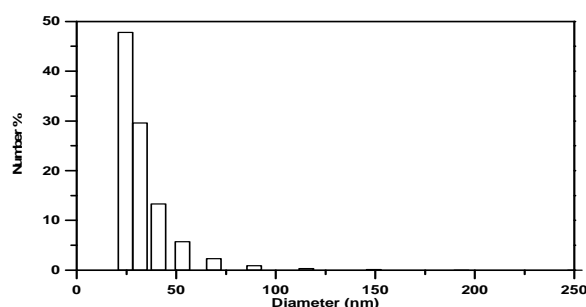


Fig. 3 Particle size distribution of nano-sized $Y_3Al_5O_{12}$:Ce

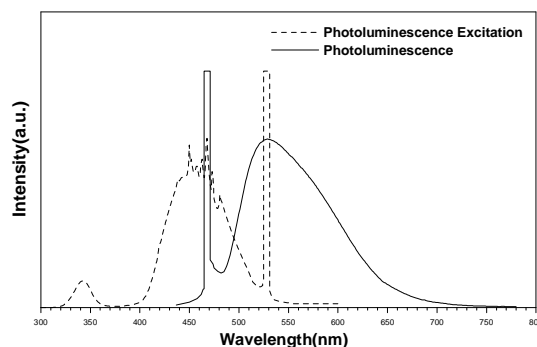


Fig. 4 PL and PLE of nano-sized $Y_3Al_5O_{12}$:Ce

Reference:
[1]Nae-Lih Wu, Sze-Yen Wang, I. A. Rusakova, "Inhibition of Crystallite Growth in the Sol-gel Synthesis of Nanocrystalline Metal Oxides", Science Vol.285(1999)