

# Syntheses and optical properties of alpha- and beta-Zn<sub>2</sub>SiO<sub>4</sub>: Mn nanoparticles by solvothermal method in ethylene glycol-water system

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## ABSTRACT

Mn doped Zn<sub>2</sub>SiO<sub>4</sub> phosphors (Zn<sub>2</sub>SiO<sub>4</sub>:Mn) **with different morphologies and crystal structures**, exhibiting different luminescence, were synthesized via a low-temperature solvothermal method in ethylene glycol-water system. Powder X-ray (XRD) and scanning electron microscopy (SEM) were used to characterize the phase purity, particle size and morphology. Photoluminescence (PL) spectra were collected and analyzed. The usual α-phase Zn<sub>2</sub>SiO<sub>4</sub>:Mn exhibited green emission centered at about 525 nm while the yellow emission centered at 563 nm resulted from β-phase Zn<sub>2</sub>SiO<sub>4</sub>:Mn. In situ XRD measurement results showed that the phase transfers from yellow to green phosphor at high temperature. The dependence of the emission intensity on the Mn<sup>2+</sup> doping concentration was also investigated, showing that the optimum doping concentrations were relatively low. XPS analysis revealed the red shifts for both Mn 2p(3/2) and Zn 2p(3/2) binding energies in yellow phosphor. The shifts might indicate Zn<sup>2+</sup> and doped Mn<sup>2+</sup> ions in β-Zn<sub>2</sub>SiO<sub>4</sub>:Mn adopt different coordination environments from tetrahedral case that is adopted in α-Zn<sub>2</sub>SiO<sub>4</sub>:Mn. (c) 2009 Elsevier B.V. All rights reserved. National Natural Science Foundation of China [20725310, 20721001, 20673085, 20671078]; National Basic Research Program of China [2007CB815303, 2009CB939804]

# Photoluminescence Behavior of Ti-Doped Zn<sub>2</sub>SiO<sub>4</sub> Thin Film Phosphors

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## Abstract

This work investigates the luminescent properties and structure of Zn<sub>2</sub>SiO<sub>4</sub>:Ti thin-film phosphor, before and after annealing up to 1000°C. The Zn<sub>2</sub>SiO<sub>4</sub>:Ti films are fabricated by RF sputtering using ceramic target. **After annealing at 800°C the β-Zn<sub>2</sub>SiO<sub>4</sub> phase is formed**, but this phase is not suitable for the application in electroluminescence. **The willemite structure (α-Zn<sub>2</sub>SiO<sub>4</sub>) is formed after annealing at 900°C or higher temperature**. Concurrently, the Zn-O-Si bonding is observed by XPS analysis and it corresponds to the willemite structure. A broad PL peak locates at 386 nm is observed for the 700°C annealed Zn<sub>2</sub>SiO<sub>4</sub>:Ti film. However, three PL peaks, centered at 380 nm, 398 nm and 402 nm, can be observed in the 900°C annealed sample. All films exhibit a high transmission (>80%) in the visible spectrum, either before or after annealing.