

## Synthesis and characteristics of ZnS:Cu,Cl blue-green nano phosphor

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**Abstract** : ZnS:Cu,Cl phosphor was coated by solid-gel reaction with SiO<sub>2</sub> outside layer. The effect of Cu<sup>2+</sup>-doping concentration has been investigated on the luminescence characteristics of ZnS:Cu,Cl blue-green phosphors for inorganic electro luminescent device. Also, SiO<sub>2</sub> coated layers' effect on luminescence characteristics. Evaluation of luminescence characteristics dependent on the synthesis conditions is important to get high-performance phosphors properties. EL and PL properties such as luminescence intensity and chromaticity of ZnS:Cu,Cl phosphors synthesized with different concentration of activator, Cu<sup>2+</sup>, were analysed separately

### 1.Introduction

ZnS:Cu,Cl phosphor was synthesized by solid-liquid state reaction with two firing steps. Each stage of the process was carefully monitored so that the final product was comparable to commercially-available phosphor. The effect of Cu<sup>2+</sup>-doping concentration has been investigated on the luminescence characteristics of ZnS:Cu,Cl blue-green phosphors for inorganic electroluminescent device. Inorganic EL devices have been used as backlights for some displays for long time [1]. In order to be a candidate for more various applications including backlight for flexible LCD, however, there are limitations in luminous efficiency, brightness and chromaticity to overcome. To get high-performance phosphors can be an approach, understanding their luminescence characteristics dependent on the synthesis

Fig.1 Flow sheet of nano ZnS:Cu,Cl phosphor preparation

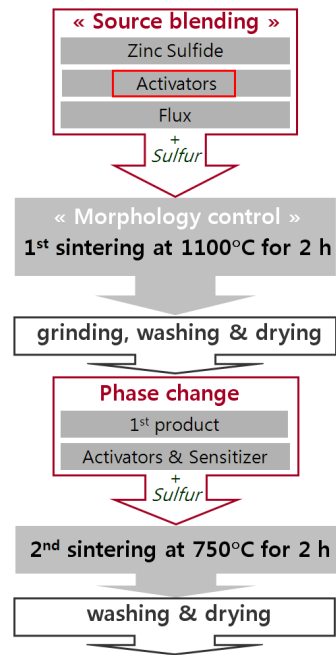
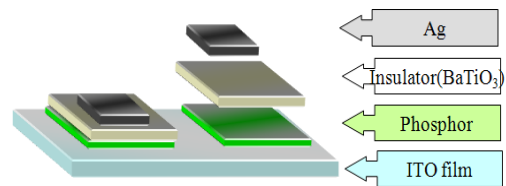


Fig.2 EL device fabrication process



conditions. EL and PL properties such as luminescence intensity and chromaticity of ZnS:Cu,Cl phosphors synthesized with different concentration of activator, Cu<sup>2+</sup>, was studied in this work.

### 2. Procedure and Results

Both of PL and EL intensities of the ZnS:Cu,Cl phosphor increased with increase of Cu

|                      | CuSO <sub>4</sub> ·5H <sub>2</sub> O(99.99%) addition |      |      |      |      |      |      |      |      |      |      |      |
|----------------------|---|------|------|------|------|------|------|------|------|------|------|------|
| Sample (No)          | 1   | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    | 10   | 11   | 12   |
| 1 <sup>st</sup> mol% | 0.02  | 0.03 | 0.04 | 0.05 | 0.06 | 0.08 | 0.10 | 0.12 | 0.13 | 0.14 | 0.16 | 0.20 |
| 2 <sup>nd</sup> mol% | 0.4   |      |      |      |      |      |      |      |      |      |      |      |

concentration, and decreased when Cu was added over 0.13 mol%. 0.13 mol% Cu-added sample at the 1<sup>st</sup> blending step showed the highest EL intensity, 164 cd/m<sup>2</sup> at an operating condition of 100V, 400Hz, having a main emission peak at 508

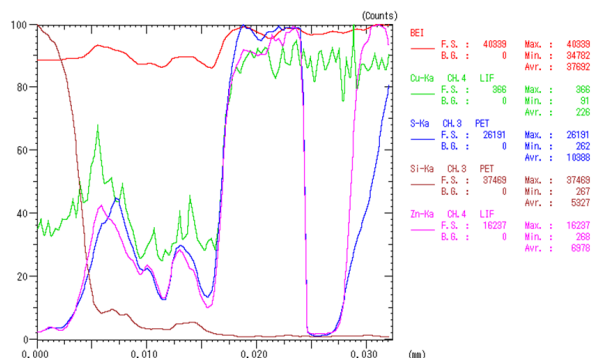


Fig.3 EPMA Analysis of SiO<sub>2</sub> coated nano powder

nm and a color coordinate at x = 0.1947, y = 0.4426 of green region, while the PL intensity was 107 cd/m<sup>2</sup> by 353 nm-excitation with a main emission peak at 501 nm and a color coordinate at x = 0.1893, y = 0.4345. The more Cu was added, the more the color coordination was green-shifted from blue region.

Further investigation such as the Cu concentration effect at the 2<sup>nd</sup> blending step and the flux effect on the EL characteristics is in progress. The luminescence characteristics of ZnS:Cu,Cl green-blue emitting phosphor is dependent on copper concentration. The more Cu was added at the 1<sup>st</sup> blending step for synthesis of ZnS:Cu,Cl phosphor, the more the color coordination was green-shifted from blue region. Based on well-optimized process, high-performance phosphors comparable to those commercially available were prepared, which exhibit high luminescence intensity and good chromaticity.

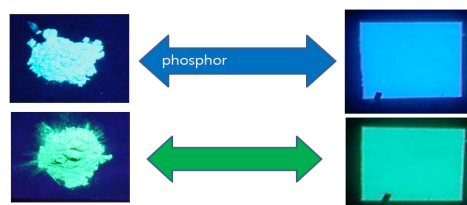
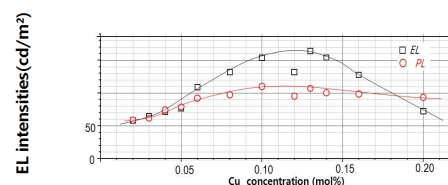
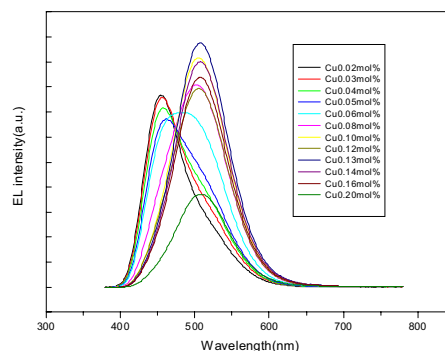
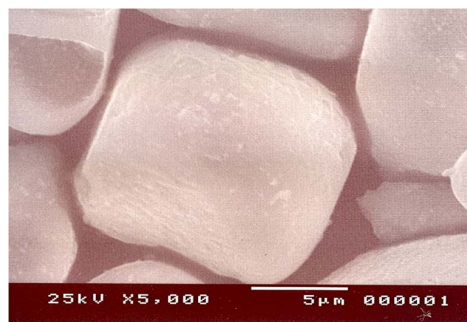


Fig.5.EL intensit and deyce color



### 3.Results

- 1)Both of PL and EL intensities of the ZnS:Cu,Cl phosphor increased with increase of Cu concentration,and decreased when Cu was added over 0.13 mol%.
- 2)The more Cu was added,the more the color coordination was green-shifted from blue region

### Reference

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