17a-D7-1

Ce^{3+}賦活黄色窒化物蛍光体の結晶構造及び発光特性

Crystal Structure and Photoluminescence of a Ce^{3+}-doped Yellow Nitride Phosphor

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Hecht *et al.* has reported that $SrAlSi_4N_7$ crystallizes in an orthorhombic crystal system with the Pna21 space group, and its structure consists of corner-sharing SiN4 tetrahedra incorporating infinite chains of edge-sharing AlN4 tetrahedra running along the c-axis. [1] Eu^{2+}-doped $SrAlSi_4N_7$ shows a broad emission band centered at 620-650 nm and an external quantum efficiency of 58.5% under the blue light excitation, indicating a promising orange-red phosphor for white light-emitting diodes (LEDs).[1,2] In this work, the synthesis and crystal structure of Ce^{3+}-doped $SrAlSi_4N_7$ phosphors were investigated, and the photoluminescence properties were evaluated and discussed.

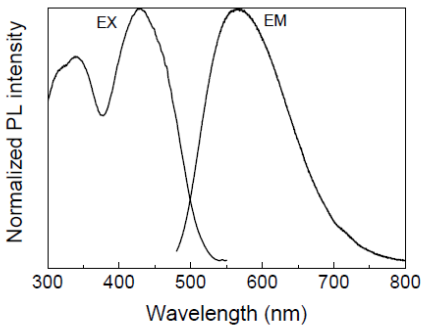

Fig.1 Photoluminescence spectra of $SrAlSi_4N_7:Ce^{3+}$

Ce^{3+}-doped $SrAlSi_4N_7$ phosphors were synthesized by gas pressure sintering. The band structure calculated by the $DMol^3$ code shows that $SrAlSi_4N_7$ has a direct band gap of 3.87 eV. The single crystal analysis indicates a disordered Si/Al distribution and an imperfect structure containing nitrogen vacancies. The phosphor can be efficiently excited by near-UV or blue light and show a broadband yellow emission peaking around 565 nm (Fig. 1). The external quantum efficiency was 38.3% under the 450nm excitation. A white light LED lamp with color temperature of 6350 K and color rendering index of Ra = 78 was achieved by combining $Sr_{0.97}AlSi_4N_7:Ce^{3+}_{0.03}$ with a commercial blue InGaN chip (Fig.2). It indicates that $SrAlSi_4N_7:Ce^{3+}$ is a promising yellow emitting down-conversion phosphor for white LEDs.

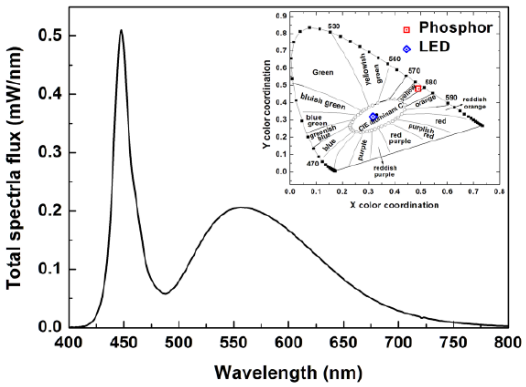

Fig.2 Emission spectrum of white LEDs using $SrAlSi_4N_7:Ce^{3+}$

[1] C. Hecht, et al., *Chem. Mater*. **21** [8] 1595-601 (2009).

[2] J. Ruan, et al., *J. Am. Ceram. Soc.*, **94** [2] 536-542 (2011).