Study of a new blue-emitting material of Sr-Al-Si-O system

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Much attention has been paid to the development of advanced luminescent materials for applications such as flat panel displays, Hg-free lamps and x-ray imaging systems. Among the various types of flat panel displays are plasma display panels (PDPs), which have a competitive edge in the large-screen display market. A commonly used blue-emitting phosphor in PDPs is Eu^{2+} doped BAM. BAM has the β-alumina type structure [1].

We have studied of relations between crystal structures and luminescent properties of new luminescent materials, and interesting results have been obtained [2,3]. In addition, detections of new compounds and determinations of these crystal structures are our interests [4]. Consequently, a new compound of Sr-Al-Si-O system has been synthesized, and we determined its crystal structure from powder X-ray diffraction (XRD) data [5] by the direction method [6,7] and the Rietveld refinement [8]. The structure is an unusual structure type, not previously seen for aluminum-based oxides, e.g. $Sr_2Al_2SiO_7$ [9], $SrAl_2Si_2O_8$ [10], $SrAl_{12}O_{19}$ [11] and $BaMgAl_{10}O_{17}$ (BAM) [1]. The new compound is in the monoclinic system in space group *C*2/*m* with cell parameters *a* = 15.1416(18)Å, *b* = 11.1843(12)Å, *c* = 4.9025(6)Å, and *β*= 108.117(5)º. There are two Sr sites in the structure. Sr1 and Sr2 atoms are connected ten and eight O atoms respectively. We have thus prepared and characterized a new luminescent material of the compound. Samples doped with Eu^{2+} exhibit blue emission. The emission is assigned to the transition from $4f^65d^1$ to $4f^7$ of Eu^{2+}. The luminescent material is effectively excited by VUV, and the intensity of emission was compared with that of the commercial phosphor, BAM:Eu^{2+}. To systematically study this luminescent material, a series of powder samples of (1-x)Sr-xEu-Al-Si-O with x ranging from 0 to 0.2, were synthesized by conventional solid-state synthesis. $SrCO_3$, Al_2O_3, SiO_2 and Eu_2O_3 (>99.99% purity) were mixed at a molar ratio given by the formula. The mixture was calcined for 2~10 h at 1500~1700 ^oC in a reducing atmosphere with one intermediate regrinding step to examine luminescent properties.

The emission peak shifted to longer wavelength with increasing Eu^{2+} concentration. The samples doped with Eu^{2+} and another rare-earth ion exhibited different luminescent properties. The crystal structures of samples were studied by the Rietveld refinement [8].

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