

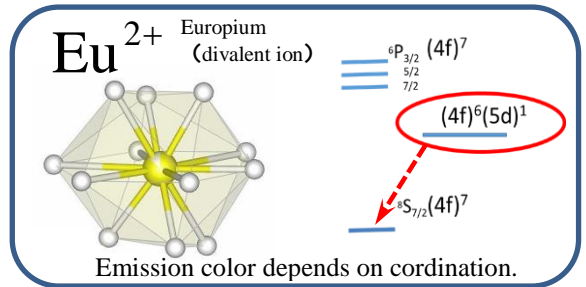
Electron states analysis of Eu-doped phosphor materials for high performance of color rendering

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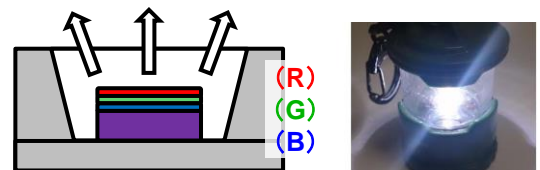


(1) Application of Eu-doped phosphors, and the coordination of Eu²⁺ ion

Recently, the phosphor materials used in white LED has been playing important role for the various applications, such as the backlight of smartphone, plasma display and so on. It has been attracted much attention to exploit the emission of three primitive color of R, G, B in one LED chip realizing natural white. The wavelength of the emission from Eu-doped phosphor much depends on the coordination state of Eu ion. It is needed to elucidate the relationship between the coordination around Eu ion and the wavelength, which leads to the development of novel phosphor material with desirable color and high emission efficiency.



Natural white from RGB

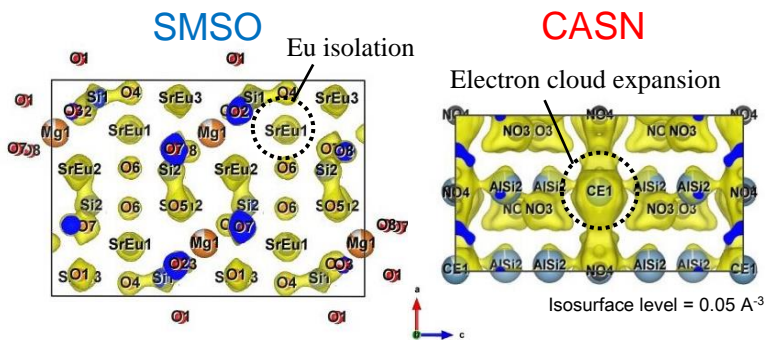


(2) Objective

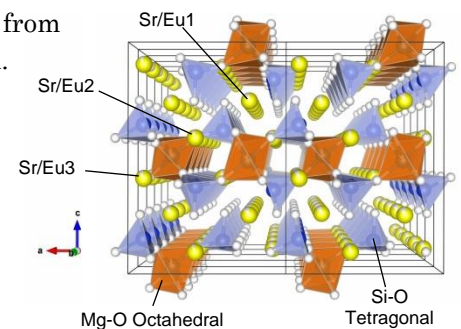
We investigated the electron states around Eu ion of three kinds of Eu-doped phosphor materials of **CaAlSiN₃:Eu²⁺(CASN)**^[1], **β-Si₅AlON₇:Eu²⁺(SiAlON)**^[2], **Sr₃MgSi₂O₈:Eu²⁺(SMSO)**^[3], which emit different colors of **red, green, blue**, respectively, by means of Rietveld analysis of power X-ray diffraction (XRD) for coordination states, Maximum entropy method (MEM) for the electron density distribution, and Vibrating sample magnetometer (VSM) for magnetization.

(3) Rietveld analysis and MEM analysis of XRD

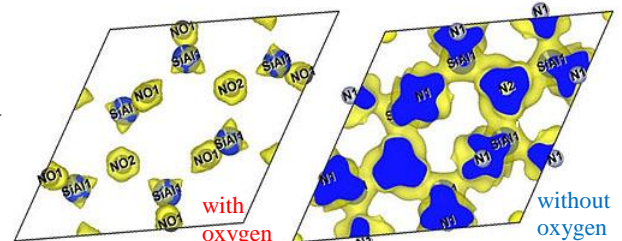
We obtained reliable structure data of R value less than 5%, and from MEM, the electron density distribution around Eu ion was mapped.



The obtained structure of SMSO



Electron distribution of SiAlON Eu 0.1%



(4) Magnetization measurement by VSM

We are now trying to estimate the ratio of Eu²⁺/Eu³⁺ from the value of magnetization in each samples, which leads to the enhancement of emission efficiency

