

Evaluation of a novel blue oxynitride conversion phosphor

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Solid state lighting (SSL) has proven to be the sole viable alternative to replace energy consuming incandescent or mercury based lighting technology. Light-emitting diodes or LEDs are gaining market share every day although improvements in color rendering and luminous efficacy are still desirable. In white LEDs, the intrinsically narrow emission band of the pumping diode is combined with one or multiple phosphor materials which convert a part of the pumping light into light of longer wavelengths. The different colors mix together, yielding white light. Blue phosphors are required for high color rendering white LEDs, in which they are combined with a near-ultraviolet pumping diode. The phosphors have to fulfill several requirements in order to be suitable for the application [1].

Oxonitridosilicates are well known host materials for conversion phosphors. Doped with divalent europium (Eu^{2+}), they are able to convert light with very high conversion efficiencies, up to 90% [2]. Furthermore, this material class is chemically stable. The luminescence is driven by the parity allowed $4f^65d^1 \rightarrow 4f^7$ transition in the optical dopant. In this work, a blue emitting phosphor, $\text{Sr}_{0.25}\text{Ba}_{0.75}\text{Si}_2\text{O}_2\text{N}_2:1\%\text{Eu}^{2+}$ is considered. The crystallographic structure of this specific composition deviates from the structures of the well-known green and bluish green phosphors $\text{SrSi}_2\text{O}_2\text{N}_2:\text{Eu}^{2+}$ and $\text{BaSi}_2\text{O}_2\text{N}_2:\text{Eu}^{2+}$ [3]. First, emphasis is put on the synthesis process. Secondly, important physical properties like photoluminescence, thermal quenching, luminescent decay and quantum efficiency of this new material are evaluated. Thirdly, variations in chemical composition and its influence on the luminescence could be studied by means of cathodoluminescence spectroscopy inside a scanning electron microscope (SEM-CL), giving a deeper insight into the luminescent properties of the powders.

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[2] V. Bachmann, C. Ronda, O. Oeckler, W. Schnick, A. Meijerink, "Color Point Tuning for $(\text{Sr,Ca,Ba})\text{Si}_2\text{O}_2\text{N}_2:\text{Eu}^{2+}$ for White Light LEDs", *Chem. Mater.* **21** (2009), 316-325.

[3] M. Seibald, T. Rosenthal, O. Oeckler, F. Fahrnbauer, A. Tücks, P. J. Smidt, W. Schnick, "Unexpected Luminescence Properties of $\text{Sr}_{0.25}\text{Ba}_{0.75}\text{Si}_2\text{O}_2\text{N}_2:\text{Eu}^{2+}$ - A Narrow Blue Emitting Oxonitridosilicate with Cation Ordering", *Chem. Eur. J.* **18** (2012), 13446-13452