A single white-emitting phosphor $(Ba,Ce,Sr)_{4-x}Li(Si,Al)_{19+x}(O,N)_{29+x}$ for white LEDs

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Single-phosphor converted white LEDs exhibit better color stability, easier device fabrication and lower cost compared to multi-phosphors converted white LEDs. The typical commercial single-phosphor converted white LED, a blue LED chip combined with a yellow emitting phosphor YAG:Ce, suffers from low color rendering due to a lack of red emitting component, preventing wide application especially for indoor illumination grade lighting. A single white-emitting phosphor is therefore highly demanded. However, it is extremely difficult to achieve white light with a single luminescent activator that covers the entire visible light range (400 – 700 nm).

Recently, we developed a white-emitting phosphor $(Ba,Ce,Sr)_{4-x}Li(Si,Al)_{19+x}(O,N)_{29+x}$ with a solid-state reaction method. Its structure is isostructural with $A_{4-x}Li(Si,Al)_{19+x}(O,N)_{29+x}$ (A = Eu, Sr), [1-3] which was discovered with the single-particle-diagnosis approach. This phosphor can be effectively excited with near-UV light and gives white light emission with two emission peaks centered at 465 nm and 620 nm. When detecting the emission at 620 nm, the excitation spectrum exhibits two bands at 200-460 nm and 460-600 nm, as shown in Fig. 1. These interesting properties show a great potential for high color rendering single-phosphor converted white LED application. To the best of our knowledge, this is the first example of a white emitting oxynitride phosphor.

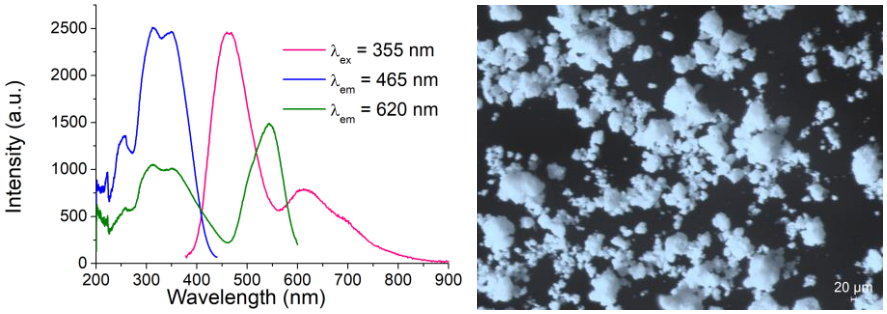

Fig. 1 Photoluminescence spectra of $(Ba,Ce,Sr)_{4-x}Li(Si,Al)_{19+x}(O,N)_{29+x}$ phosphor (left) and a luminescence photo of phosphor particles with 365 nm UV lamp irradiation (right).

[1] S. Funahashi, T. Takeda., N. Hirosaki, R.-J. Xie, *the 64th JSAP Spring Meeting*, 14a-411-4, Yokohama, Japan, 2017.

[2] C.-Y. Wang, T. Takeda, S. Funahashi, R.-J. Xie, N. Hirosaki, *The 78th JSAP Autumn Meetings*, 7p-A414-6, Fukuoka, Japan, 2017.

[3] C.-Y. Wang, T. Takeda, S. Funahashi, R.-J. Xie, N. Hirosaki, *SPIE. Optics + Photonics 2017*, 10378-19, San Diego, United States, 2017.