

## 2006

### **First delivery of 100 lm/W white LED samples (Nichia)**

#### **~ Discrete Semiconductor/Others ~**

For white LED (for lighting), the most widely adopted type is a combination of blue LED and a phosphor. This includes a pseudo white type which combines a blue LED and a yellow light emitting phosphor, and a high color rendering index type which combines a blue LED, a green phosphor, and a red phosphor.

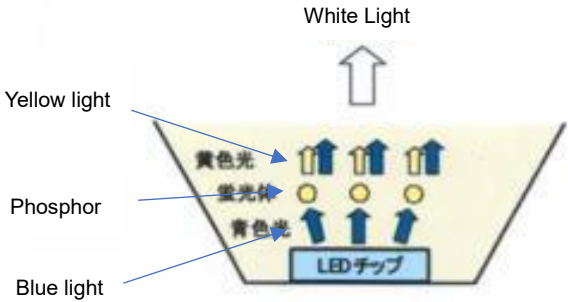
As shown in the Figure, when the blue light emitted from the blue LED is absorbed by the phosphor, it emits yellow light. The yellow light and the blue light not absorbed by the phosphor are mixed and appear white. The emission spectrum of this white LED has two peaks of blue light and yellow light.

On the other hand, in the high color rendering index white type, the blue light emitted from the blue LED is absorbed by green and red fluorescent materials, emitting green light and red light respectively. These green, red, and blue lights mix and appear white. In the emission spectrum, there are peaks in the blue, green and red regions, and color reproducibility is superior to that of the pseudo white type.

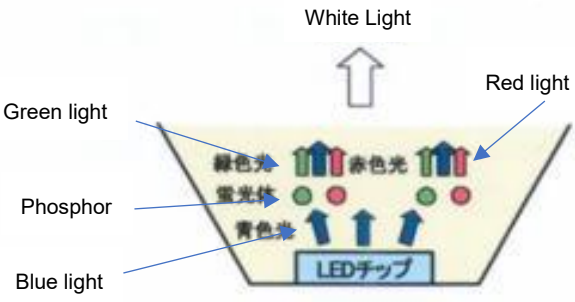
In 1992, a p-n junction type GaN blue LED was realized, and with three primary color (RGB) LED light sources in place, there was a possibility that LED could be used not only for displays but also as white light LED illumination light source.

In 1996 Nichia developed a pseudo white LED with a GaN blue LED (465 nm) and a yellow YAG:Ce phosphor to achieve a luminous efficiency of 5 lm/W and was used as a backlight source for liquid crystal displays. In 1998, NEDO's "The light for 21st Century" project under the Ministry of Economy, Trade and Industry started, and it spurred the development.

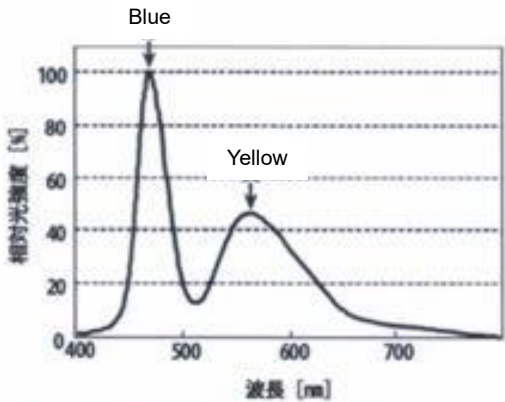
In 2007, a luminous efficiency of 100 lm/W with Ra (color rendering) of 60 was achieved, exceeding 20 lm/W for incandescent bulbs and 50-100 lm/W for fluorescent lamps. The lifetime is estimated to be more than 40,000 hours, exceeding 1,500 hours for incandescent bulbs and 12,000 hours for fluorescent lamps.



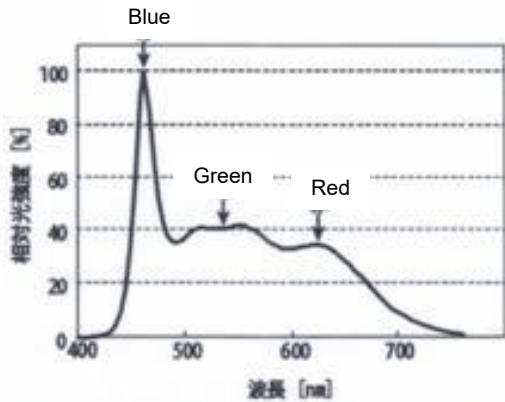
Emission Principle of Pseudo-White Type



Emission Principle of High CRI White Type



Spectrum of Pseudo-White Type



Spectrum of High CRI White Type

Fig.1: Principle of light emission and emission spectrum of white LED