

NEWS from ARO-FE (October 2001) :

ZnSe-based White Light Emitting Diode expected to be a backlight source for a color display of mobile phones, digital cameras, digital video recorders etc..

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ZnSe-based white light emitting diode (OYO BUTURI Magazine - <http://www.jsap.or.jp/> - Vol. 70, No 5, 2001)

Toshihiko TAKEBE, Itami Research Laboratories, Sumitomo Electric Industries, Ltd. has developed a phosphor-free white light emitting diode (LED) based on an entirely new concept with ZnSe-based material. The device utilizes a phenomenon unique to the ZnSe homoepitaxial structure. That is, a portion of the main greenish blue emission from the quantum well active layer of a p-n junction diode is absorbed by the conductive substrate, which in turn gives off an intense broad yellow emission band peaked around 585nm by photoluminescence. These two emission bands are synthesized yielding a spectrum that appears white to the naked eye. ZnSe-based white LED lamps exhibited a high optical output of 4.3mW, a low operation voltage of 2.7V, and a high luminous efficiency of 20 lm/W at a forward current of 20mA (**Figure 1**).

REMARKS:

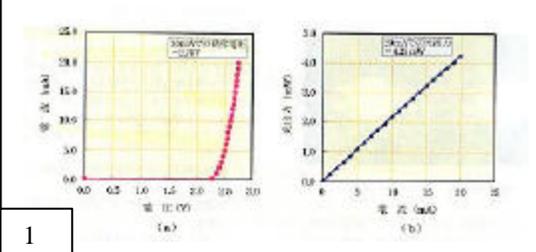
The characteristics of the ZnSe-based white light emitting diode are as follows.

- It is a phosphor-free so that a manufacturing process is simple. InGaN LED uses a phosphor to convert blue light to yellow light.
- An operation voltage (2.7 V) is lower than that of InGaN LED (3.6 V). It is critical, because the available voltage of Li-ion battery is 3.6 V.
- It is easy to control wavelength precisely.

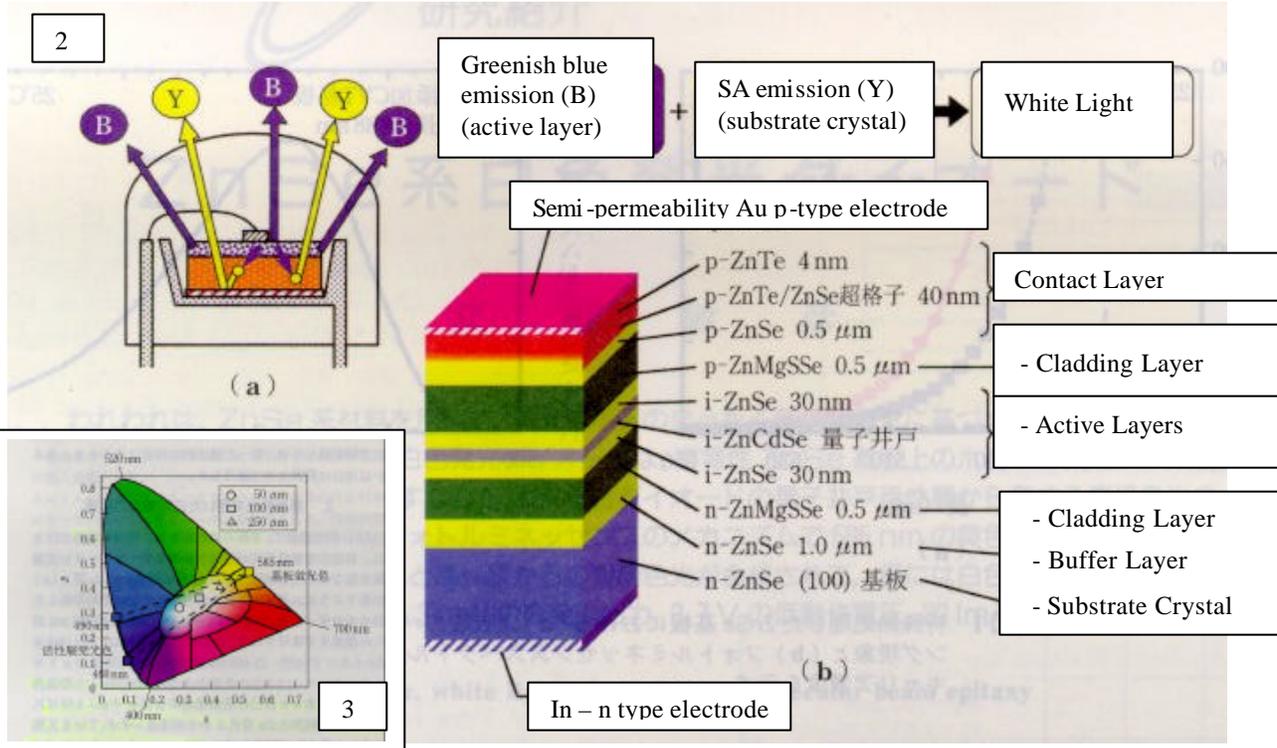
The device utilizes a phenomenon unique to the ZnSe homoepitaxial structure as shown in **Figure 2**. Greenish blue light (485nm) is emitted from the ZnCdSe quantum well active layer of a p-n junction diode. A portion of this emission is absorbed by the conductive substrate, which in turn gives off an intense broad yellow emission band peaked around 585 nm by photoluminescence (**Figure 3**). These two emission bands are synthesized to yield a spectrum that appears white to the naked eye.

Figure 1a shows the current I of the ZnSe-based white LED as a function of the operation voltage V.

Figure 1b shows the optical output power P as a function of the current I.



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Figure 2: a. Diagram showing white light is obtained. A portion of blue light emitted from active layer is absorbed by the substrate which gives off yellow light; b. Cross section of ZnSe based light emitting diode. **Figure 3:** Chromaticity Diagram - Complimentary color (480-490) to yellow emission band 585nm is obtained by controlling the concentration ratio of Cd