Novel Nitride-based Phosphors for LED Applications

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Light-emitting diodes (LEDs) replace conventional lamps in more and more applications. They are already used in internal and external automotive lighting systems, traffic lights and some information displays, e. g. in mobile phones and PDAs. Their key advantages are their size, brightness, low power consumtion and physical robustness.

However, although first white LEDs were presented several years ago, the field of general lighting and full-color display applications remains still closed because of their insufficient radiant power and color rendering. The main challenge is to find suitable blue-, green-, and red emitting phosphors for light conversion at the relatively long LED wavelengths. While most oxide phosphors cannot be excited at wavelengths of about 400 nm or longer, novel nitride-based compounds show a considerable nephelauxetic effect on dopant sites. This significantly lowers the necessary excitation energies. Thus, doping these host lattices with cerium or europium in many cases yields highly efficient, stable phosphors suitable for LED light conversion.

We have developed several blue, green and red emitting nitride-based phosphors. Compared to sulfide-based phosphors, these novel compounds show much higher radiation and chemical stability. Thus, with the help of these phosphors white light with a high color rendering index can be obtained by tri-band mixing like in fluorescent lamps, opening a completely new market for full-color white light LEDs.

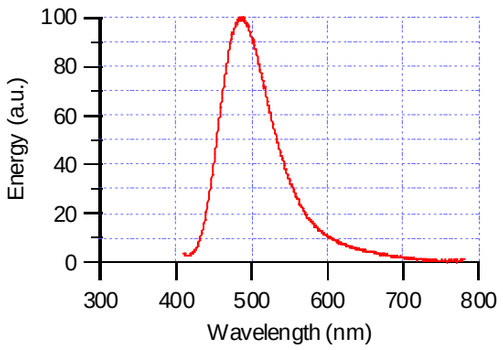

Figure: Emission spectrum of an efficient novel nitride-based phosphor compound doped with europium.