

# Powerful gallium nitride red light-emitting diodes made with europium and magnesium codoping

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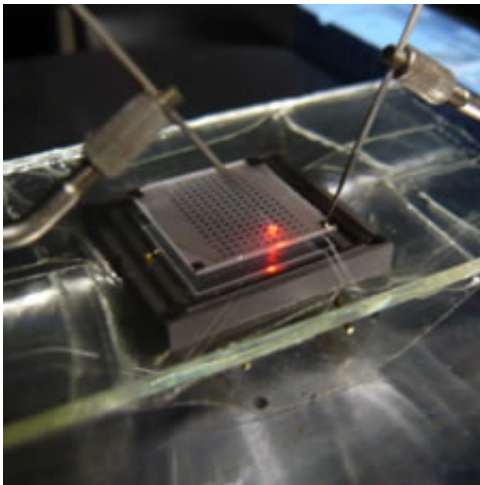


Fig. 1 Typical emission image of Eu doped GaN based LED.

(Phys.org) —Toyohashi Tech researchers fabricate powerful red light-emitting diodes by codoping GaN with Eu and Mg. The details are described in the June 2013 issue of Toyohashi Tech e-Newsletter: [www.tut.ac.jp/english/newsletter/index.html](http://www.tut.ac.jp/english/newsletter/index.html)

Europium (Eu) doped nitride semiconductors show potential for realization of novel optical devices, such as a low threshold lasers and single photon emitters, due to their sharp line and high efficiency emission.

However, not all the Eu ions in semiconductor are incorporated in optically active sites that can be excited through the GaN host. Therefore, it is important to develop methods to selectively incorporate Eu ions in higher-efficiency optical sites.

Here, Hiroto Sekiguchi and colleagues at Toyohashi University of Technology and Hamamatsu Photonics Ltd have improved the emission intensity from Eu ions by Mg co-doping and fabricated [red](#) LEDs with Eu and Mg doped active layer grown by ammonia source MBE.

The optimal Mg co-doping selectively enhanced a specific emission site and contributed to a [photoluminescence](#) (PL) intensity increase of more than one order of magnitude. From the ratio of PL integrated intensity at 25 K to that at 300 K, the PL efficiency was determined to be as high as 77%. On the basis of these results, Eu doped GaN based LEDs were fabricated. Clear rectification characteristics with a turn-on voltage of 3.2 V were observed and a pure red emission was observed by the naked eye at room temperature. These results suggest that Eu and Mg doped GaN is expected to be utilized for realizing new nitride-based light-emitting devices.

**More information:** Sekiguchi, H. et al. Red-Light-Emitting Diodes with Site-Selective Eu-Doped GaN Active Layer, *Jpn. J. Appl. Phys.* 52 (2013). [DOI: 10.7567/JJAP.52.08JH01](https://doi.org/10.7567/JJAP.52.08JH01)

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