

Improved electrical property of InGaN/GaN light-emitting diodes by using a Mg-doped AlGaN/GaN superlattices

J. K. Sheu^{a)} and G. C. Chi

Optical Sciences Center, National Central University Chung-Li, 32054, Taiwan

M. J. Jou

Epistar Corporation, No. 48 Park Ave. II, Science-Based Industrial Park, Hsinchu, 300, Taiwan

Low resistivity of Mg-doped $\text{Al}_{0.15}\text{Ga}_{0.85}\text{N}/\text{GaN}$ strained layer superlattices has been demonstrated. It shows that the blue Mg-related PL band in Mg-doped $\text{Al}_{0.15}\text{Ga}_{0.85}\text{N}/\text{GaN}$ SLs peaked around 2.9 eV could be a distant D-A pair character. The hole concentration and mobility are $3 \times 10^{18}/\text{cm}^3$ and $5 \text{ cm}^2/\text{V}\cdot\text{s}$, respectively. The measured value of hole concentration is more than ten times the value obtained in the $\text{Al}_{0.15}\text{Ga}_{0.85}\text{N}$ bulk layer. Hall effect measurements for this structure show a highly lateral conductivity, which the high activation efficiency is due to the strain-induced piezoelectric field [1]. In addition, the feasibility of InGaN/GaN blue LEDs involved a Mg-doped $\text{Al}_{0.15}\text{Ga}_{0.85}\text{N}/\text{GaN}$ SLs has been grown by MOVPE. Fig. 1 shows the forward current-voltage and dynamic resistance characteristics of the diodes without and with a Mg-doped $\text{Al}_{0.15}\text{Ga}_{0.85}\text{N}/\text{GaN}$ strained layer superlattices. As shown in Fig. 1(a), the forward voltage is 3.8 V and 3.0 V at 20 mA DC current for LED I and LED II, respectively. In addition, the series resistance of is about 40Ω and 18Ω for LED I and LED II, respectively, as shown in Fig. 1(b). The forward voltage is significantly reduced by the employment of Mg-doped $\text{Al}_{0.15}\text{Ga}_{0.85}\text{N}/\text{GaN}$ strained layer superlattices, suggesting the decreased series resistance in the devices. This is significantly smaller than those conventional devices with operation voltage of about 3.8 V.

a): email: jksheu@joule.phy.ncu.edu.tw

NOTE: The authors prefer to present this paper by post form.

Reference

1. P. Kozodoy, M. Hansen, S. P. DenBaars, and U. K. Mishra, "Enhanced Mg doping efficiency in $\text{Al}_{0.2}\text{Ga}_{0.8}\text{N}/\text{GaN}$ superlattices", *Appl. Phys. Lett.*, **74**, 3681(1999).

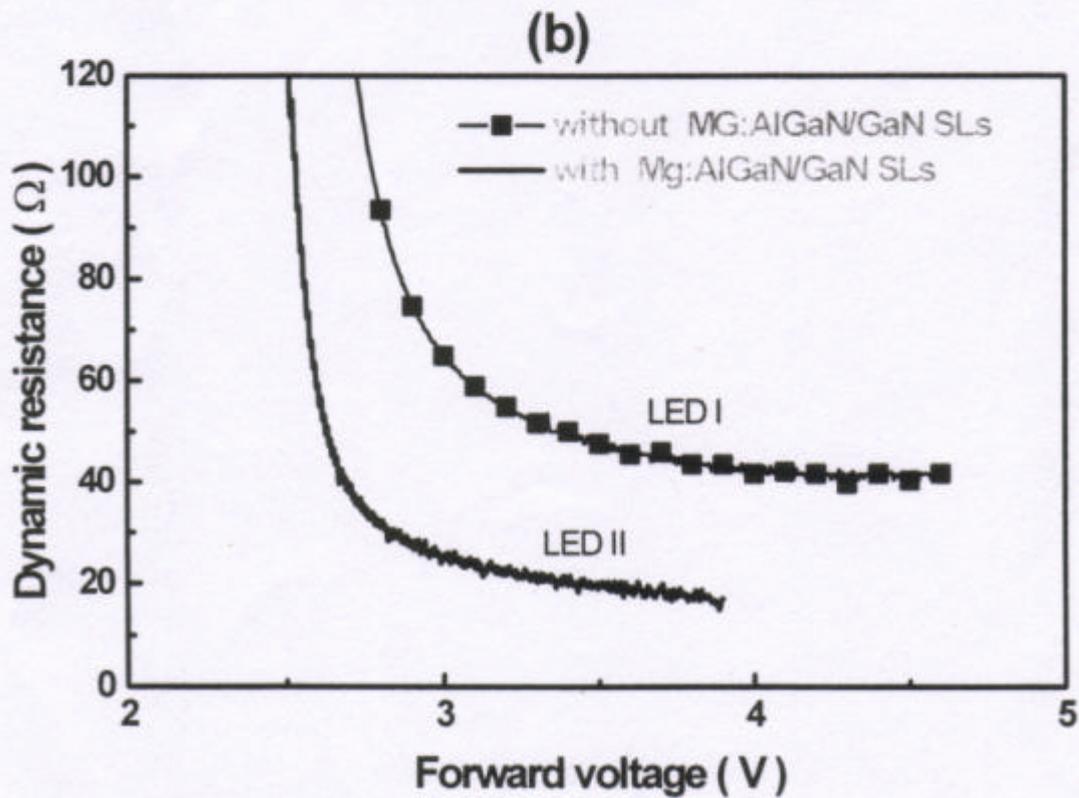
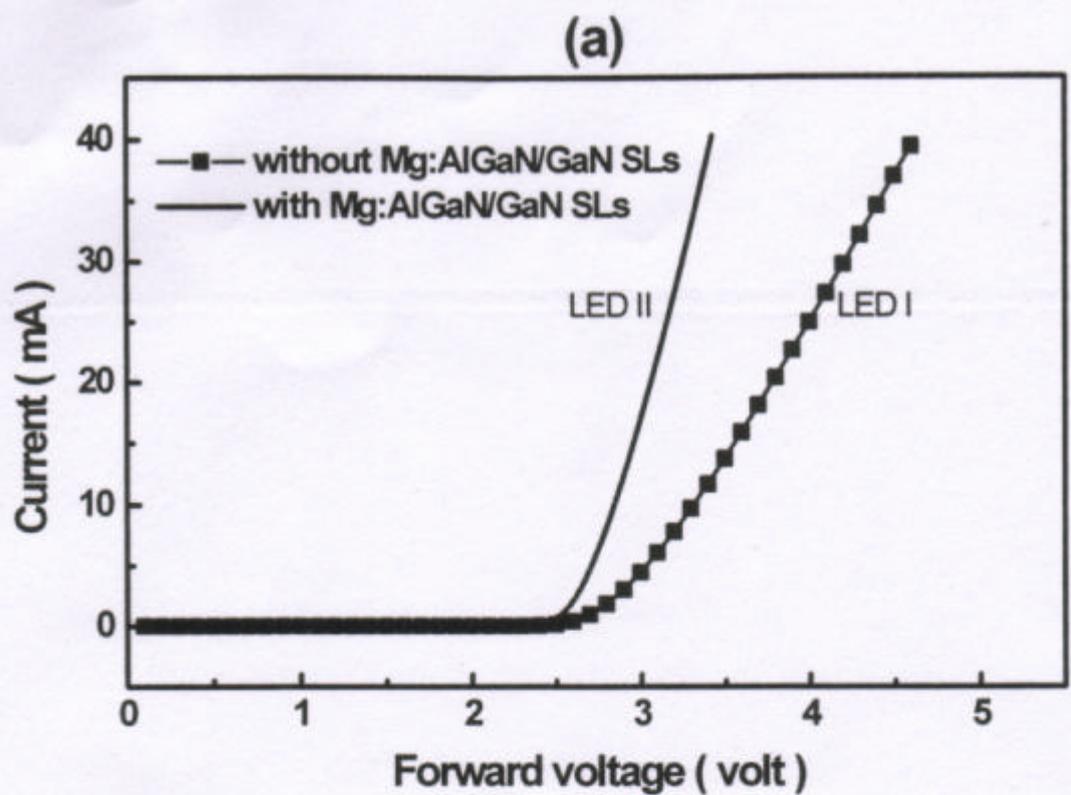


Fig. 1(a) Forward I-V and (b) dynamic resistance characteristics of the of the InGaN/GaN LEDs without and with $\text{Al}_{0.15}\text{Ga}_{0.85}\text{N}/\text{GaN}$ SLs top layer.