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**EFFECTS OF THREE-STEP MAGNESIUM DOPING IN  
p-GaN LAYER ON THE PROPERTIES OF InGaN  
BASED LIGHT EMITTING DIODE**

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**ABSTRACT-** In this work, indium gallium nitride (InGaN) based light emitting diode (LED) was grown on a 4-inch c-plane patterned sapphire substrate using metal-organic chemical vapor deposition. Three-step magnesium (Mg) doping profile was proposed to enhance the efficiency of the LED and the attention was paid to the effects of the Mg doping concentration of the second p-GaN layer. The Mg doping levels were varied by changing the flow rates of bis-cyclopentadienyl magnesium (Cp<sub>2</sub>Mg), i.e., 150, 250, and 300 sccm. To assess the electrical, crystallographic, and optical properties of the InGaN-based LEDs, various characterization tools were used. The results showed that the hole concentration was affected by Cp<sub>2</sub>Mg flow rate. For the light output power, it was found that LEDs with low and high hole concentration exhibit lower output power due to low conductivity and low mobility. Apart from that, it was also found that the light emission of the LED wavelength, redshifted as the hole concentration increases. Through this study, it can be deduced that the hole concentration of the second p-GaN layer has a significant effect on the performance of the LED.

**Keywords:** Light emitting diode, p-GaN, Doping profile, Hall measurement, PL measurement.