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Shaari, A. , Ahmad Fajri, F.A. , Ahmad Noorden, A.F. (2021) *Microwave and Optical Technology Letters*

# Doping Effect on Bandgap Energy and Luminescence Spectrum for AlN-Based Semiconductor

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[Ahmad Noorden, Ahmad Fakhurrazi](#)  ; [Abdul Hamid, Ahmad Noor](#)  ; [Abdul Aziz, Azni](#) 

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## Abstract

This ongoing work reports the heavy doping effect on the Aluminum Nitride ( AlN ) semiconductor (SC) material, illustrated via its energy-band structure (EBS). The research correlates the bandgap energy (BE) and depletion region (DR), which are then applied to the estimation of light-emitting diode (LED) luminescence spectrum (LS). The measurements are compared with different dopant concentrations ( $1 \times 10^{18} \text{cm}^{-3}$  –  $1 \times 10^{21} \text{cm}^{-3}$ ). Having the Gallium Arsenide (GaAs) properties as the

Strain Optimization in Silicon P-Type Double-Gate MOSFET at 7nm Channel Length

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controlled variable, the EBS is validated with literature findings. The measured band gap energy of AlN shifts from 6.2435 to 6.2326 eV. It decreased as the dopant concentration increased. However, the active spatial regions, reduced from  $(1.0250 \times 10^{-1} \text{ to } 4.5000 \times 10^{-3} \mu\text{m}) \times 1 \mu\text{m}^2$ . The findings are compared with the output LS of LED using the same SC material. The changes in BE and DR are consistent with the LS peak intensity wavelength and relative intensity to all the chosen doping concentrations. Though acquiring this consistency, an extensive discussion with collaboration in material science studies will further strengthen the understanding regarding these behaviours. © 2022, The Author(s), under exclusive license to Springer Nature Singapore Pte Ltd.

### Author keywords

Aluminum nitride; Bandgap energy; Doping; Luminescence spectrum

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