

Comparison of Ga and N polar GaN-based electroluminescent diodes

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Nowadays, semiconductor-based light-emitting diodes (LEDs) are an important component in many areas of life, from lighting to consumer and industrial electronics. One of the most promising materials used to manufacture LEDs is gallium nitride [1]. In spite of the profitable built-in polarization arrangement for emitters grown on nitrogen-polar substrate[2] the technique for fabricating structures based on it is still not up to par with the level of sophistication of commercially developed gallium-polarity technology [3].

The purpose of the present study is to provide a detailed study and analysis of the performance of LEDs that were fabricated using both polarities in plasma-assisted molecular beam epitaxy. LED samples that we prepared on nitrogen polar substrates showed lower turn-on voltages compared to Ga-polar samples (Fig 1(a)). Nevertheless, they have significantly higher leakage current at reverse voltage, as well as two orders of magnitude lower optical output power (Fig 1(b)). A comparison of contact resistivities using the transfer length method revealed that samples on nitrogen polar substrate exhibit resistivities that are three orders of magnitude higher compared to samples with gallium polarity. Presented results show directions for optimisation of both epitaxy and processing for devices obtained on N-polar GaN.

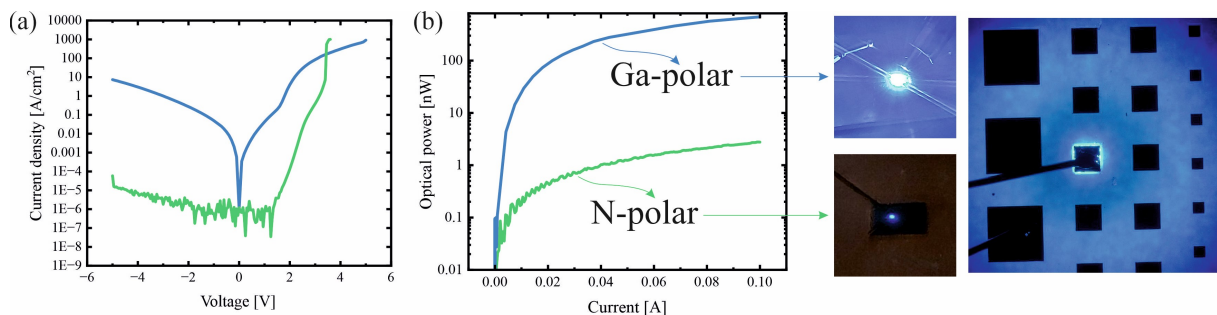


Figure 1: Comparison of the Ga- and N-polar LEDs performance: (a) current-voltage, and (b) light-current characteristics. Pictures present LEDs under the same bias.

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References

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