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Ohmic Contact Properties of Nonpolar GaN Grown on r-plane Sapphire Substrate with Different Miscut Angle

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The properties of Ni/Au Ohmic contacts formed on nonpolar a-plane GaN grown on r-plane sapphire substrate with different tilt angles are investigated using current-voltage (I-V) measurements. To investigate the effects of pattern direction and size on Ohmic contact properties of a-plane GaN, transmission line method (TLM) patterns are formed either along c-axis and m-axis on nonpolar GaN surface with different size. I-V measurement results show that the size of TLM pattern and formation direction of electrode have an effect on the electrical properties of a-plane GaN. The large sized patterns show the relatively lower sheet resistance compared to the small sized patterns. In addition, the sheet resistance of a-plane GaN along m-axis shows lower values than that along the c-axis. Finally, the effects of miscut angle of r-sapphire substrate (0.2^{o}, $0.4^{o}$and 0.6^{o}) on electrical properties of a-plane GaN will be discussed.

Keywords: nonpolar, miscut angle, GaN, Ohmic

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Application of Polystyrene/SiO2 Core-shell Nanospheres to Improve the Light Extraction of GaN LEDs

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To improve the optical and electrical properties of commercialized GaN-based light-emitting diodes (LEDs), many methods are suggested. In recent years, great efforts have been made to improve the internal quantum efficiency and light extraction efficiency (LEE) and promising approaches are suggested using a patterned sapphire substrate (PSS), V-pit embedded LED structures, and silica nanostructures. In this study, we report on the enhancement of photoluminescence (PL) intensity in GaN-based LED structures by using the combination of SiO2 (silica) nanospheres and polystyrene/SiO2 core-shell nanospheres. The SiO2 nanospheres- coated LED structure shows the slightly increased PL intensity. Moreover the polystyrene/SiO2 core-shell nanospheres-coated structure shows the more increase of PL intensity comparing to that of only SiO2 spheres- coated structure and the conventional structure without coating of nanospheres. The Finite-difference time-domain (FDTD) simulation results show corresponding result with experimentally observed results. The mechanism of enhancement of PL intensity using the coating of polystyrene/SiO2 core-shell nanospheres on LED surface can be explained by the improvement in extraction efficiency by both increasing the probability of light escape by reducing Fresnel reflection and by multiple scattering within the core-shell nanospheres.

Keywords: GaN LED, Silica, Nano, Extraction