Investigation of DC and RF Characteristics of Spacer Layer Thickness Engineered Recessed Gate and Field-Plated III-Nitride Nano-HEMT on β-Ga 2 O 3 Substrate

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Abstract

In this article, the performance analysis of recessed gate and field-plated III-nitride Nano-HEMT (High Electron Mobility Transistor) developed on β-Ga $_2$O $_3$ substrate with and without AlN spacer layer is studied. The two-dimensional electron gas (2DEG) formed at the AlGaN/GaN interface is crucial in changing the characteristics of AlGaN/GaN HEMTs. The different transport, DC, and AC characteristics of the proposed III-nitride HEMT with spacer layer are numerically simulated and compared with the HEMT without spacer layer. The major findings of this research demonstrate that the AlN spacer layers large band off set, strong polarisation field, and high barrier allow the increased concentration of 2DEG, when it is introduced between AlGaN/GaN interface. Furthermore, the AlN layer moves the 2DEG distribution shifts from the surface, which diminishes interface scattering. Further, AlN thickness variation influences the polarisation field and conduction band offset, which impacts the concentration and mobility of 2DEG.

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