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Modeling of nanoscale gallium nitride (GaN) HFET with gate field-plated heterostructure

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The excellent microwave power performance demonstrated in AlGaN/GaN HEMTs (high-electron mobility transistors) results from the combination of high current density with high voltage operation [1], which benefits from the high sheet charge density in these hetero-structures (1013 cm^{-2}), the high carrier mobility (1500 cm^2/Vs) and saturation velocity (1.5×10^7 cm/s) in the channel and the high breakdown voltage inherent in the GaN material. However, their reliability still limits their applications in today's electronic systems. The newly developed Gate Field-Plated AlGaN/GaN high electron mobility transistors show improved performance due to the electric field reduction in the device channel and surface modification [2, 3]. We report on two dimensional numerical simulations of Gate-Recessed and Field-Plated AlGaN/GaN HFETs where all the important device parameters have been defined, the insulator thickness and permittivity under the Gate Field-Plated i also an important design parameter to attain higher breakdown voltage, thus an improvement of the performances of HFETs

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