Novel High-Performance GaN Transistors

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Several novel high-performance GaN-based devices have been recently proposed. InAlN/GaN high electron mobility transistors (HEMTs) provide higher polarization charges without the drawback of high strain and demonstrate maximum current capabilities surpassing those of AlGaN/GaN structures [1]. We shall discuss the models of the material system [2], implemented in our two-dimensional device simulator and present results for novel InAlN/GaN MOS-HEMT structures [3], which lead to suppression of gate leakage and current collapse, while preserving high transconductance.

Normally-off operation of AlGaN/GaN HEMTs is desired for various applications, but proved to be difficult to achieve. We shall present a simulation study of two approaches proposed recently for shifting the threshold voltage in positive direction. In the first approach a thin InGaN cap layer introduces a polarization field which raises the conduction band of the AlGaN/GaN interface [4]. In the second approach a recessed thick AlGaN barrier is used to attain the gate leakage low together with an excellent device performance [5]. Using calibrated models for III-nitride materials [6], we explore device specific effects and optimization potentials.

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