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# Enhancement-mode Metal-Oxide-Semiconductor Metamorphic High-Electron-Mobility Transistor

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The high Al-content in the InAlAs Schottky layer generates more surface states to further induce a gate leakage issue. Moreover, the narrow energy-gap high-indium-content channel is typically accompanied by impact ionization, which brings about high gate leakage current and current instability. Therefore, the breakdown voltage and output power are degraded, and this is harmful to high-power and low-noise applications. Suitable oxidation or passivation can satisfy dangling bonds to reduce surface recombination centers and suppress electron trapping within the surface states. The gate-recess process also creates surface states which generate parasitic capacitances that degrade device performance. Oxide films are commonly used for growth on the III-V compound semiconductor to fabricate the metal-oxide-semiconductor (MOS) structure with a larger gate voltage swing and lower leakage current.

In addition, the advantages of using enhancement-mode (E-mode) metamorphic high-electron-mobility transistors (MHEMTs) for single supply operations can facilitate circuit design and construction and render them less complex. Without a gate recess, the oxide film is obtained directly by oxidizing the InGaAs capping layer in the liquid phase oxidation (LPO) growth solution, and fully planar surface is performed around the active region. It can also reduce the cost of chemical usage and disposal. In this paper, we fabricated E-mode InAlAs/InGaAs MOS-MHEMTs with a LPO-grown oxide without gate recess. Base on the measurement results, the breakdown voltage is increased and the leakage current is improved for the E-mode InGaAs/InGaAs MOS-MHEMT as compared to those of Schottky-gate MHEMT, which will make the proposed low-temperature LPO-grown oxide suitable for device applications.

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