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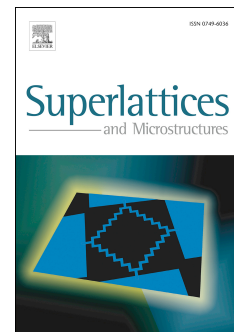
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Enhancement of Breakdown Voltage in AlGaIn/GaN HEMT using Passivation Technique for Microwave Application

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ABSTRACT

The AlGaIn/GaN High Electron Mobility Transistor (HEMT) on Silicon Carbide (SiC) substrate with SiO₂ passivation is proposed in this paper. The maximum drain current of 0.8 A/mm is observed at $V_{gs} = 0$ V for gate width (W_G) = 600 μ m. The breakdown voltage of device with SiO₂ passivation is compared with breakdown voltage of device with SiN passivation and it is found that the breakdown voltage improved in the device with SiO₂ passivation. The breakdown voltage of the device with SiO₂ and SiN passivation are 312 V and 287 V, respectively. Furthermore, the improvement in the breakdown voltage is observed with increase of buffer thickness. The obtained breakdown voltages are 312 V, 390 V and 412 V for buffer thickness of 2 μ m, 3 μ m and 5 μ m, respectively. In addition to breakdown analysis, the impact of passivation on intrinsic capacitance is investigated and found that the device with SiO₂ passivation exhibits a reduction in gate-source capacitance (C_{SG}) and gate - to - drain capacitance (C_{GD}).

Keywords: AlGaIn, Breakdown Voltage, GaN, HEMT, High Power, High Frequency.

I. INTRODUCTION

AlGaIn/GaN HEMT is a worthy candidate for high voltage, wide range of operating temperature and high frequency applications [1-3]. These attracting application capability of AlGaIn/GaN HEMT is described to its superior physical properties, such as high sheet carrier density, higher thermal conductivity, wide band gap, high breakdown field, high electron mobility and high electron velocity [4]. In addition, the AlGaIn/GaN HEMT have unintentionally doped two dimensional electron gas (2DEG) [5-6]. With these notable GaN

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