fully fabricated on sapphire substrate. The HEMT with T shape recessed gate of 0.15 μm gate length exhibited excellent current saturation properties without no kink effect and no current degradation. The maximum extrinsic trans-conductance was as high as 450 mS/mm. To our knowledge, this is the highest value of any GaN-based FETs ever reported. Moreover, the HEMTs exhibited excellent high frequency performances. A maximum unity current cut-off frequency f_T of 60 GHz and a maximum oscillation frequency f_{max} of 108 GHz were obtained.

key words: *GaN, AlGaN, HEMT, recessed gate, sapphire, microwave, high frequency, high trans-conductance*

High Power AlGaN/GaN HFET

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A high power AlGaN/GaN HFET with a very lower on-state resistance was fabricated. The on-state resistance was about 8 mΩ·cm^2 at 370 V and a switching voltage was about 370 V and a switching speed was 10 ns. We also fabricated an inverter circuit using AlGaN/GaN HFETs. This inverter was composed of DC-DC converter and AC inverter using these HFETs, respectively. Using this inverter, DC 30 V was converted to AC 100 V. It was thus demonstrated for the first time that an inverter circuit using high power AlGaN/GaN HFETs was operated.

key words: *GaN/AlGaN, HFET, MBE, on-state resistance*

High Frequency Diamond FETs Utilizing Hydrogen-Terminated Surface Channel

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Diamond RF FETs on hydrogen-terminated p-type surface channel have been realized. f_T of 0.2 μm Al-gate diamond MESFET reaches 11 GHz. On the other hand, due to the improvement of mobility by CaF_2 passivation effect, the RF characteristics of the MISFETs with CaF_2 gate insulator are higher than those of MESFETs at the comparable gate length. f_T of 15 GHz has been obtained in 0.4 μm gate diamond MISFET. This value is the highest in diamond FETs ever reported and comparable to the devices on other wide-gap materials. More than 30 GHz of f_T is expected by the reduction of gate length down to 0.2 μm.

key words: *diamond, field-effect transistor, hydrogen-terminated surface channel, MISFET, cut-off frequency, maximum frequency of oscillation*

Electrical Characteristics of Interface Defects in Oxides Grown at 1200℃ in Dry Oxygen Ambient on Silicon Carbide and Their Thermal Annealing Effects

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Effects of high-temperature oxidation and post-oxidation annealing processes were examined by capacitance-voltage (*C-V*) characteristics of 4 cyclic hexagonal type silicon carbide (4H-SiC) metal-oxide-semiconductor (MOS) structures. Oxides for the MOS structures were grown at 1200℃ in dry oxygen ambient for 3 hours and annealed in argon ambient in a temperature range from 500 to 950℃ for 3 hours. The difference in the shift direction of *C-V* curves for n- and p-type MOS structures was examined in connection with the charge states of defects at the interface, and thermal annealing mechanisms were discussed.

key words: *4H-SiC, dry oxidation, MOS, interface traps, argon annealing*

High-Voltage 4H-SiC pn Diodes Fabricated by p-Type Ion Implantation

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High-dose Aluminum-ion (Al^+) implantation and characteristics of pn junction fabricated by Al^+ or boron-ion (B^+) implantation into 4H-SiC (0001) have been investigated. A minimum sheet resistance of 3.6 kΩ/□(p-type) has been achieved by the combination of Al^+ implantation at 500℃ and subsequent annealing at 1700℃. A 4H-SiC (0001) pn diode fabricated by shallow Al^+ and deep B^+ implantation has exhibited a high breakdown voltage of 2900 V with a low on-resistance of 8.0 mΩcm^2 at room temperature. The diodes fabricated in this study showed positive temperature coefficients of breakdown voltage, meaning avalanche breakdown. For the first time, 4H-SiC ($11\bar{2}0$) pn diodes