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Si-Diffused Enhancement-Mode GaN MOSFET SOOHWAN JANG, FAN REN, Department of Chemical Engineering, University of Florida, STEPHEN PEARTON, BRENT GILA, MARK HLAD, CAMMY ABERNATHY, HYUCKSOO YANG, SANG YOUN HAN, Department of Materials Science and Engineering, University of Florida, CHING-JEN PAN, JENN-INN CHYI, Department of Electrical Engineering, National Central University, Taiwan — Gallium Nitride (GaN) field effect transistors (FETs) have attracted considerable interest as high power electronics for use in the electric utility industry, defense and space applications, and hybrid vehicles. There were some demonstrations of enhancement mode GaN based MOSFETs, however the device performance was poor due to the low channel mobility caused by high temperature (1100-1200 C) activation annealing after Si implantation. Si implantation was used to form the source and drain region in the GaN MOSFET fabrication. For the alternative method of Si implantation**,** Si diffusion into GaN was studied as a function of encapsulant type (SiO_2 or SiN_X) and diffusion temperature. Using a SiO_2 encapsulant,the Si diffusion exhibited an activation energy of 0.57 eV with a prefactor of 2.07x10^{-4} $cm^2.sec^{-1}$ in the temperature range 800-1000C. An enhancement mode MgO/GaN-on-Si metal-oxide semiconductor field effect transistor (MOSFET) was fabricated utilizing Sidiffused regions under the source and drain to provide an accumulated channel. The devices showed improved transconductance and drain current relative to previous devices with Si-implanted source/drain regions.

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