Device Structures Utilizing Barrier Enhancement Conductive Materials on N-polar III-N
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BACKGROUND

Current methods for improving the high-frequency and high-power performance in N-polar GaN HEMTs struggle to preserve a desirable aspect ratio while using a small gate length. While gate dielectrics can be removed by depositing conductive materials directly on N-polar GaN, the barrier height values are less than the difference between the work function of the conductive material and the electron affinity of GaN. Therefore, devices with limited barrier height values cause high leakage and impede applications in diodes or transistors.

DESCRIPTION

Researchers at the University of California, Santa Barbara have developed a device with barrier enhancement conductive materials on N-polar III-N materials that can overcome the limited barrier height value and reduce leakage. N-polar III-N device performance is improved by using barrier materials with Schottky barriers greater than or equal to the ideal Schottky barrier height. In addition to the device’s application to N-polar GaN Schottky diodes and HEMTs, it can also be used on other diodes and transistors that require contact between conductive materials and N-polar III-N materials.

ADVANTAGES

▶ Improves device performance
▶ Overcomes non-ideal Schottky barriers
▶ Reduces leakage

APPLICATIONS

▶ HEMTs
▶ Transistors
▶ Power Electronics
▶ RF Electronics

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

▶ Achieving “Active P-Type Layer/Layers” In III-Nitride Epitaxial Or Device Structures Having Buried P-Type Layers
▶ High-Quality N-Face GaN, InN, AIN by MOCVD
▶ Defect Reduction in GaN films using in-situ SiNx Nanomask
▶ Laser Diode With Tunnel Junction Contact Surface Grating
▶ High Mobility Group-III Nitride Transistors with Strained Channels
▶ A Structure For Increasing Mobility In A High-Electron-Mobility Transistor
▶ Fabrication of Relaxed Semiconductor Films without Crystal Defects
▶ Improved Fabrication of Nonpolar InGaN Thin Films, Heterostructures, and Devices
▶ Methods for Locally Changing the Electric Field Distribution in Electron Devices
▶ Controlling Linearity in N-Polar GaN MISHEMTs
▶ Technique for the Nitride Growth of Semipolar Thin Films, Heterostructures, and Semiconductor Devices
▶ Enabling Epitaxial Growth On Thin Substrates
▶ (In,Ga,AJ)N Optoelectronic Devices with Thicker Active Layers for Improved Performance
▶ N-polar III-N Semiconductor Device Structures Enabled by Wet Chemistry
▶ GaN-based Vertical Metal Oxide Semiconductor and Junction Field Effect Transistors
Novel Current-Blocking Layer in High-Power Current Aperture Vertical Electron Transistors (CAVETs)

III-N Transistor With Stepped Cap Layers

Polarization-Doped Field Effect Transistors with Increased Performance

Wafer Bonding for Embedding Active Regions with Relaxed Nanofeatures

III-N Based Material Structures and Circuit Modules Based on Strain Management