Microwave GaN based Field Effect Transistors

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Abstract:

Unique properties of GaN and related semiconductors make them superior for high-power applications. High current values in GaN-based field effect transistors can be combined with very high breakdown voltages. These devices have potential of replacing traditional GaAs based microwave field effect transistors

Extended abstract

Unique properties of GaN/AlN/InN and related semiconductors make them superior for high-power applications. Device physics and device design of GaN-based FETs are different from those for more conventional GaAs and InGaAs based transistors. In GaN/InN/AlN transistors, strain control and polarization effects are very important, and a new epitaxial technique (called MEMO-CVD), a novel strain energy band engineering (SEBE) approach, and quantum well designs have been developed to control strain, polarization, and non-ideal effects. Also, a very large sheet electron density at heterointerfaces in the GaN-based FET channels allows for a novel and unique insulated gate heterostructure design that has many advantages over more conventional heterostructure FETs. Special field plate designs can dramatically increase the breakdown voltage. As a result, high current values in GaN-based microwave field effect transistors can be combined with very high breakdown voltages, and these devices have potential of replacing traditional GaAs and InGaAs based microwave field effect transistors.