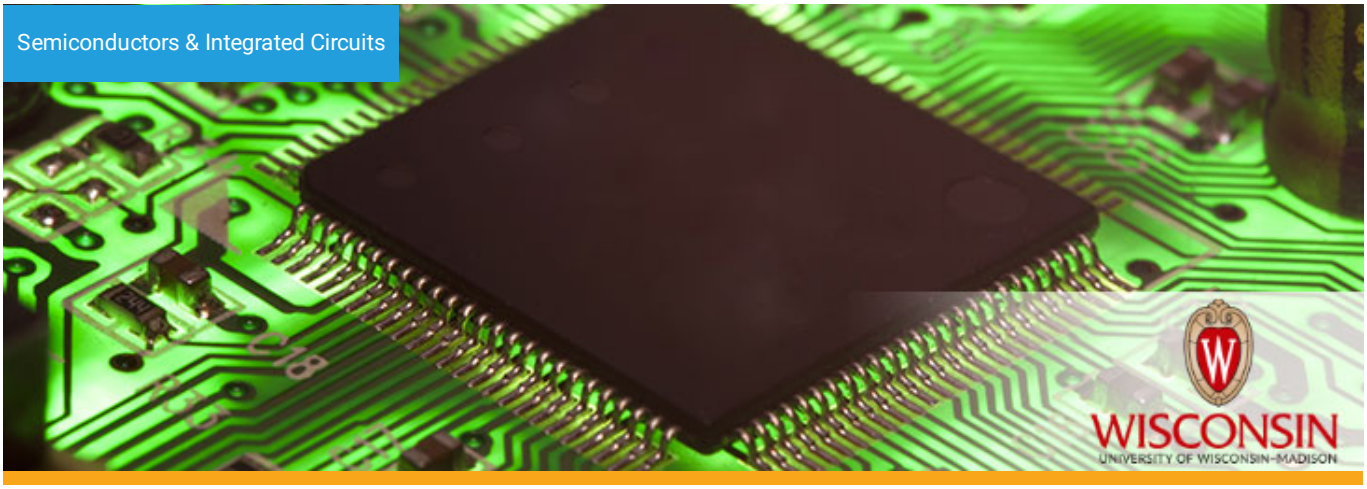

NUCLEATION LAYER DESIGN FOR THE GROWTH OF INDIUM-CONTAINING GROUP III-NITRIDE-BASED LONG WAVELENGTH EMITTERS

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Overview

Group III-nitride semiconductors are characterized by the ability to cover a wide emission wavelength range from the deep ultraviolet (UV) to the near infrared (NIR) (i.e., from 6.2 eV to 0.7 eV). InGaN and AlGaN alloys can cover this emission wavelength range by tuning the indium (In) and aluminum (Al) contents in the alloy composition. However, as the In content of an InGaN alloy increases, it becomes more difficult to grow InGaN as a high-quality crystal, and this represents a significant challenge to the fabrication of longer emission light-emitting diodes (LEDs) using InGaN. One reason it is difficult to grow high-quality In-containing group III-nitride alloys, such as InGaN, with a high In-content InGaN is that In evaporates preferentially at high temperatures. Therefore, low-temperature growth ofInGaN is commonly used to maintain a high In content in the alloy. However, low temperature growth is sub-optimal for achieving a high crystal quality, so InGaN grown at low temperatures (e.g., < 900 °C) is typically characterized by a high defect density, including a high surface defect density, and a rough surface. As a result, light-emitting active regions grown on the low-quality InGaN have low efficiencies.

The Invention

UW-Madison researcher have developed Group III-nitride heterostructures that include a strain-relaxed In-containing group III-nitride layer with a high crystal quality for use as buffer layers in the fabrication of light¬ emitting devices. The technology can also be used for light-emitting devices, such as LEDs and LDs, that incorporate the heterostructures and metal-organic chemical vapor deposition (MOCVD) methods for growing the heterostructures. The methods can be used to grow InGaN alloys and other In-containing group III-nitrides with a wide range of In contents; however, the methods are particularly suited for the growth of In-containing group III-nitride

Tech Fields

- Semiconductors & Integrated Circuits : Components & materials

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