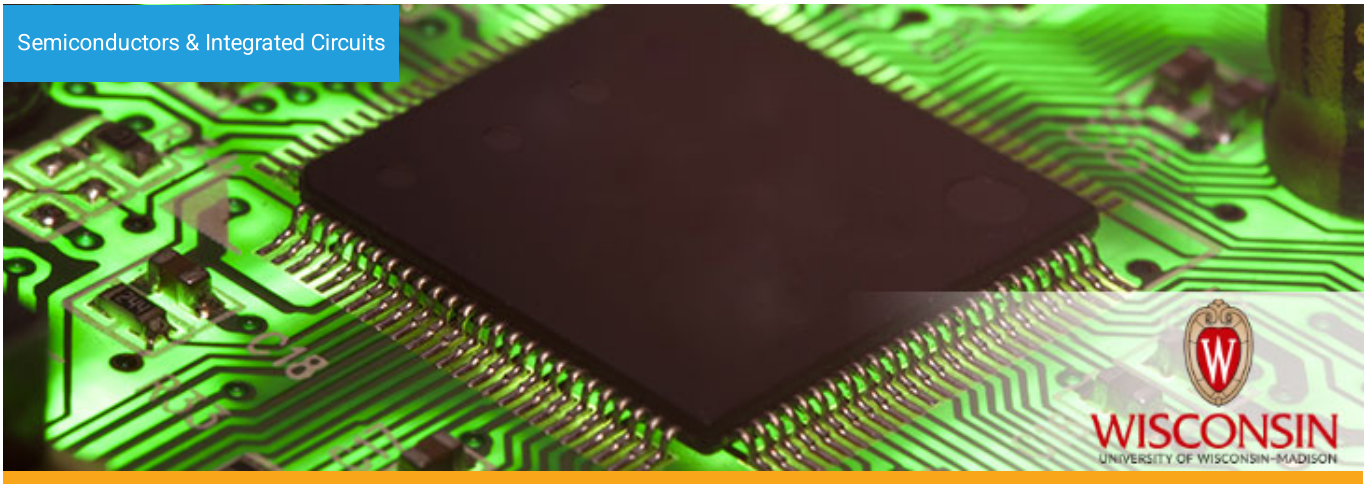




STRAIN-RELAXED PSEUDO-SUBSTRATES AND METHODS OF MAKING SAME USING THERMAL POROSIFICATION

[View U.S. Patent Application Publication No. US-2025-0351500 in PDF format.](#)

WARF: P240122US01

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N-polar GaN-based high electron mobility transistors (HEMTs) hold promise as a viable option for high-frequency operation within the millimeter-wave spectrum and have demonstrated outstanding performances in both small and large signal operations.

The porosification of Ga-polar and N-polar GaN buffer layers in a pseudo-substrate can be achieved using electrochemical etching or thermal-decomposition techniques. Electrochemical etching requires complex processing steps, such as mesa isolation, and electrochemical etching of highly n-type doped GaN buffer layers, which are not suitable for HEMT processing, as the highly n-type doped layer can cause microwave losses during high frequency operation. Also, the relaxation is dependent on the size of the mesa, which can cause in-plane variation. The thermal decomposition technique is more suitable for large-area porosification and minimizing processing steps. However, it is not straightforward to achieve porous InGaN films. Also, the extremely high indium content in the decomposition layer can degrade the material quality and generate a high density of hillocks, which cannot be mitigated in subsequent depositions of InGaN pseudo-substrate above the InGaN decomposition layer.

The Invention

UW-Madison researchers have developed pseudo-substrates of III-nitride materials and growth methods using an in-situ porosification technique which is robust and reliable. Electronic or optoelectronic devices incorporating the pseudo-substrates include epitaxial active layers on a pseudo-substrate. Such devices include high electron mobility transistors, light-emitting diodes, and laser diodes. These pseudo-substrates can be made via in-situ porosification performed using a metal-organic chemical vapor deposition (MOCVD.)

Additional Information

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Tech Fields

- [Semiconductors & Integrated Circuits: Components & materials](#)

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