

# MICROSPHERE TEMPLATED GALLIUM NITRIDE GROWTH & LIFTOFF

US Pat. No.: 8,425,681; 8,932,403

Technology Readiness Level: 5

*The basic technological components are integrated so it can be tested in a simulated environment*

The LED market is one of the fastest growing markets worldwide, driven by demand for clean solid state lighting, LED displays and mobile devices. GaN-based materials are essential components of these technologies. Due to the very high cost and lack of availability of bulk GaN substrates, current GaN production methods rely on silicon, sapphire or silicon carbide substrates. These low-cost substrates suffer from a large number of defects, which limit efficiency and lead to early device failure.

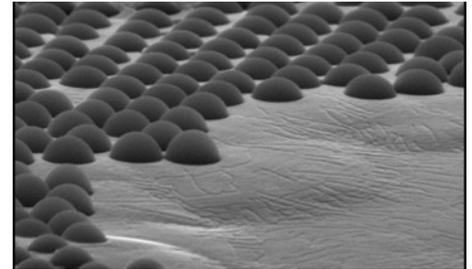
Sandia National Laboratories has developed a novel and inexpensive method for the growth and removal of low-defect density GaN using microsphere layers. In contrast to current methods for GaN dislocation reduction involving lithographically patterned masks, this new method does not require lithography and produces uniform material over the entire wafer. This method also can lift-off GaN-on-GaN substrate devices.

## TECHNICAL BENEFITS

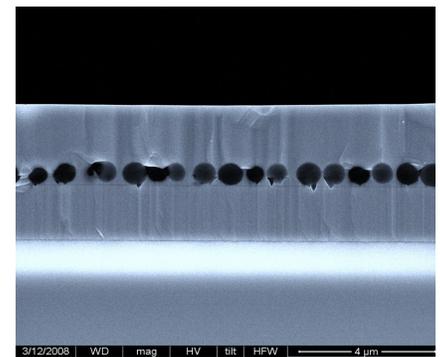
- Low Cost
- Reduces crystal defects by over 90%
- Allows for easy substrate removal
- Does not require lithography
- Produces material over the entire wafer
- Can lift-off GaN-on-GaN substrate devices

## INDUSTRIES & APPLICATIONS

- LED displays
- Laser diodes
- Solid-state lighting
- High power transistors
- Mobile devices



GaN partially grown through sphere



Low-dislocation GaN layer grown on sapphire using a defect-filtering sphere template layer