MICROSPHERE TEMPLATED GALLIUM NITRIDE GROWTH AND LIFTOFF

Sandia National Laboratories

intellectual property MANAGEMENT, LICENSING & ALLIANCES

TECHNOLOGY READINESS LEVEL: **5**

MICROSPHERE TEMPLATED GROWTH IS NOW ROUTINE ON RESEARCH SCALE WAFERS

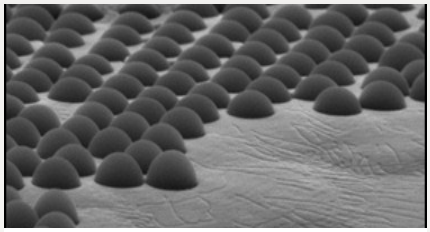
US PATENT APPLICATION #S

12/388,103 & 13/113,123

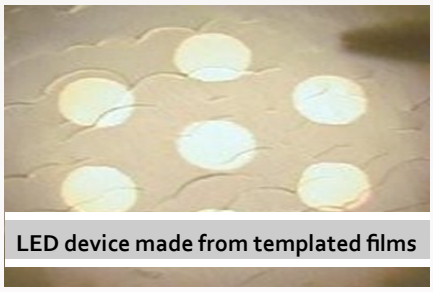
TECHNOLOGY SUMMARY

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.

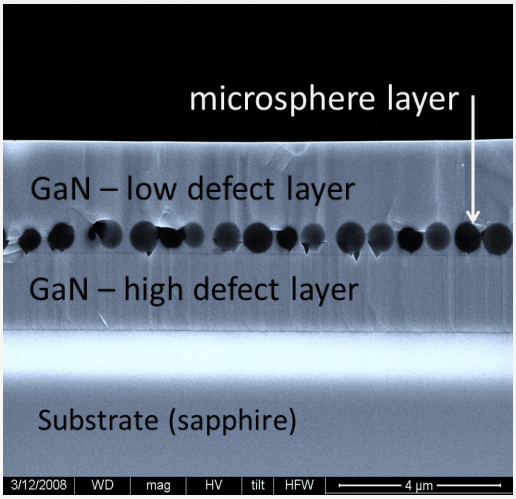
Sandia National Laboratories has developed an elegant and inexpensive method for the growth and removal of low-defect density GaN using microsphere layers. In contrast to current methods for GaN dislocation reduction involving lithographically patterned masks, this new method does not require lithography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



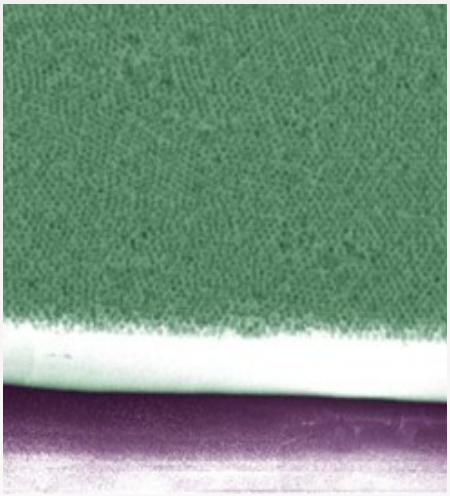
GaN partially grown through sphere



LED device made from templated films



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



Freestanding GaN layer lifted off substrate by etching

POTENTIAL APPLICATIONS

- LED Displays
- Laser Diodes
- Solid-State Lighting
- High Power Transistors
- Mobile Devices

TECHNOLOGICAL BENEFITS

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

TECHNOLOGY INQUIRY?

For more information or licensing opportunities contact us at

ip@sandia.gov

Refer to SD 10594, SD 11582

NNSA National Nuclear Security Administration

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U.S. DEPARTMENT OF ENERGY