

Low-Temperature GaN Capping for InGaN microLEDs: Technology for Cost-Effective, Scalable, and Efficient MicroLED Displays

Scientific Achievement

Low-temperature deposition of GaN capping layer on InGaN-based quantum wells provides a cost-effective way to realize all-InGaN-based highly efficient red micro light-emitting diodes.

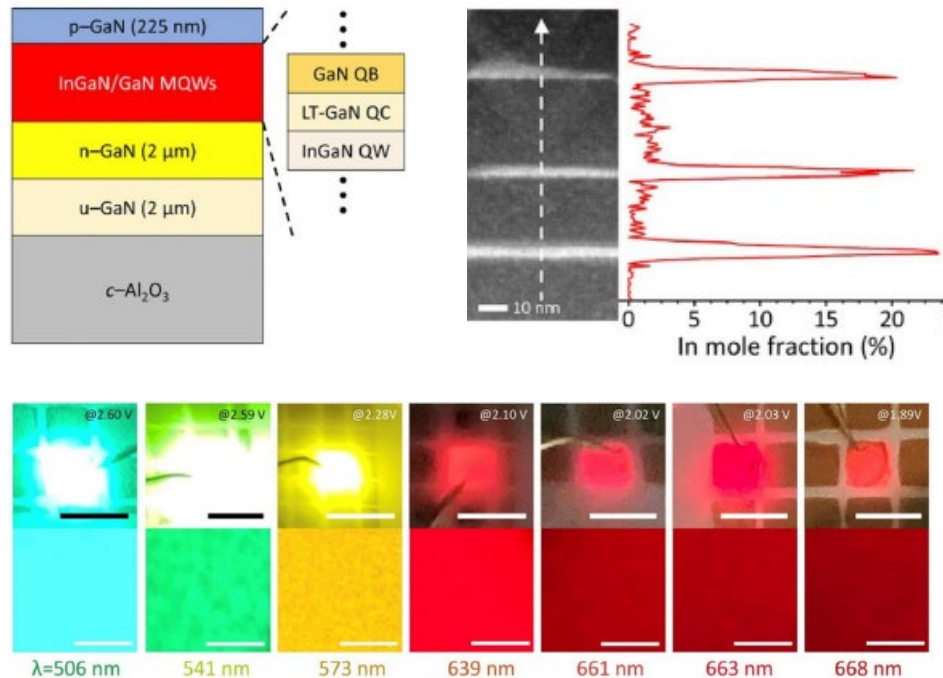


Figure: (Top, Left) Schematic illustration of the GaN layer protecting the InGaN quantum wells. (Top, Right) Cross-sectional TEM image showing the suppression of indium out-diffusion in the InGaN quantum wells with the GaN capping layer. (Bottom) Electroluminescence of microLEDs spanning from blue to deep red, achieved solely by varying quantum well thickness without strain engineering or changing the material systems.

Significance and Impact

The issue of poor efficiency of red InGaN microLEDs is solved and the need for complex strain engineering eliminated.

Research Details

- GaN capping layer on the InGaN quantum wells prevented quantum wells from unintentional indium out-diffusion and segregation that degrade the red-emitting region.
- Demonstrated efficient deep red (>655 nm) electroluminescence in the microLED without strain engineering.
- Achieved red emission in the developed microLEDs without compromising crystal quality.

Choi, J.; Yang, S.; Jung, B. O.; Kim, T.-I.; Bae, J.; Yang, W.; Kim, J.; Jo, J.; Shao, G.; Kim, C.; Hwang, J. S.; Chung, J. W.; Joo, M.; Park, J.-H.; Jeon, D.-W.; Kim, D.; Cho, I.; Hwang, S.-M.; Lee, I.-H.; Derby, B. K.; Yoo, J.; Shin, D.-S.; Kim, J.; Oh, S. H.; Choi, Y. J.; Hong, Y. J. All-InGaN/GaN Red Light-emitting Diodes with Low-temperature-Grown GaN Capping Layer. *Scientific Reports*. 2026.

Work was performed, in part, at the Center for Integrated Nanotechnologies.



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