National Aeronautics and Space Administration

NASA

TECHNOLOGY SOLUTION

Electrical and Electronics

Integrated Multi-Color Light Emitting Device Made With Hybrid Crystal Structure

Method to create red, green, and blue LED device structures on single wafer

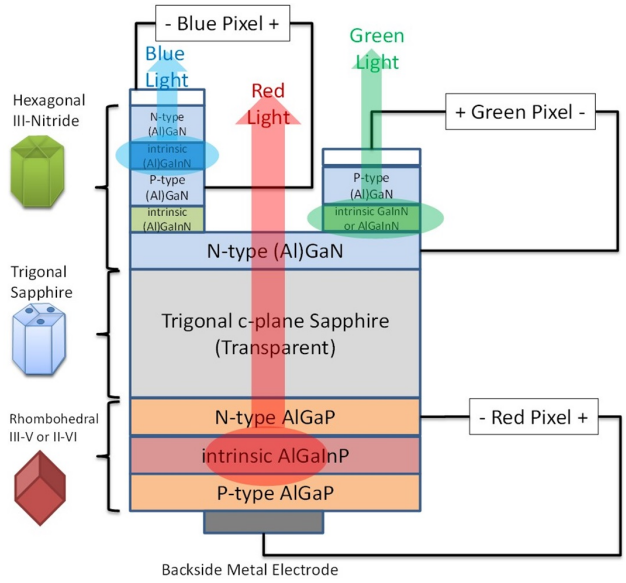
NASA Langley Research Center has developed a process methodology for making red, green and blue LED device structures on the same substrate (wafer), which is not possible today using current techniques. Such devices are manufactured individually because of different crystal structures. This innovation is enabled by the prior innovations by NASA Langley Research Center.

BENEFITS

- Ability to process red, green and blue LED devices on the same substrate
- LED display and lighting is a significant market opportunity.

THE TECHNOLOGY

This technology is an integrated hybrid crystal LED display device that can emit red, green, and blue colors on one single wafer. Todays LEDs are built with many compound semiconductors with type-I direct bandgap energies of two different crystal structures. While Red, Orange, Yellow, Yellowish Green LEDs are commonly made with III-V semiconductor alloys of Aluminum Gallium Indium Phosphide (AlGaInP) and Aluminum Gallium Indium Arsenide (AlGaInAs) with cubic zinc blende crystal structures, the higher energy colors such as green, blue, purple, and Ultra-Violet(UV) LEDs are made with III-Nitride compound semiconductor of AlGaInN alloys with hexagonal wurtzite crystal structures. Because the atomic crystal structures are different for red LED and green/blue LEDs, the integration of these semiconductor LEDs as individual R, G, B pixels on one wafer was almost impossible or very difficult so far.



Fabricated device structure and circuit diagram for newly invented multi-color(R,G,B) light emitting pixels

APPLICATIONS

The technology has several potential applications:

- LED displays
- LED televisions

PUBLICATIONS

Patent No: 9,455,374; 9,711,680

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More Information

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