

BMDO Update

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Gallium Nitride Film Nears Perfection

Northwestern University's Center for Quantum Devices (CQD; Evanston, IL) has grown some of the world's highest-quality group III-nitride films. These films can be applied to advanced ultraviolet (UV) photodetector arrays and emitters, which are used in optoelectronic devices such as light-emitting diodes (LEDs) and semiconductor lasers. CQD has demonstrated the lowest defect densities reported to date for gallium nitride (GaN) films at less than 10 million/cm² (10⁷/cm²). It obtained this high-quality film using an advanced low-pressure, metal-organic-chemical-vapor-deposition (LP-MOCVD) reactor, and the films approach the theoretical limit of perfection for a single crystal.

By controlling the addition of aluminum (Al) to the reactor, CQD has also produced AlGaN-UV detectors that can be tailored to wavelengths between 200 and 365 nanometers (nm). Ozone is opaque from 200 to 280 nm; therefore, the ability to see above ozone in the atmosphere helps to detect and track missiles. By introducing organometallics and hydrides, CQD has also been able to produce p- and n-doped AlGaN. By controlling the doping, the researchers could produce homo-junction and heterojunction photodetectors, LEDs, and semiconductor lasers. Funded through BMDO's IS&T program, CQD has applied for three patents related to its GaN work, and welcomes collaborations.

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