Fully epitaxial microcavities: Open the door to quantum optoelectronic effects in the GaN-based system

June 16 2010

For the very first time, a team of researchers in Germany has introduced quantum dots in fully epitaxial nitride laser structures without the need for hybrid systems -- effectively eliminating the cumbersome method of combining different materials from epitaxy and evaporation. This should help pave the way to a further optimization of lasers and single photon emitters in the visible spectrum region, according to the team.

A detailed description of their findings appears in the journal Applied Physics Letters, which is published by the American Institute of Physics (AIP).

"Gallium-nitride-based laser diodes are very promising materials for the development of efficient light sources in the UV-blue to green spectral region. They're already in use, for example, in BluRay (high-data-storage disc) players," explains Kathrin Sebald, the optics team's senior postdoctoral researcher from the University of Bremen's Institute of Solid State Physics. "By reducing the size of the optically active material down to the nanometer scale (quantum dots), the efficiency of such devices can be increased much further -- opening the door to the use of quantum optoelectronic effects."

When combined with optical microcavities, the emitted light can be confined to ultra-small volumes by resonant recirculation. In such quantum optical devices, microcavities can coax quantum dots to emit

spontaneous photons in a desired direction, which leads to an enormously increased output, Sebald notes. Applications of these devices are as diverse as their properties.

More information: The article, " Optical properties of InGaN quantum dots in monolithic pillar microcavities" by Kathrin Sebald et al will appear in the journal Applied Physics Letters. apl.aip.org/

Provided by American Institute of Physics