Relocating LEDs from silicon to copper enhances efficiency

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Chinese researchers have succeeded in transferring gallium nitride (GaN) light-emitting diodes (LEDs) grown on a layer of silicon to a layer of copper.

The new copper substrate enabled the GaN crystals to release some of the internal stresses generated when they originally formed. This relaxation helped minimize the so-called "quantum confined stark effect," a vexing problem for LEDs that reduces their efficiency. In comparison with LEDs on silicon substrates, the light output of LEDs on copper was enhanced by 122 percent. The relocation of the LEDs produced no obvious deterioration in the crystals' light-emitting region, known as multiple quantum wells.

The researchers attributed the improvements in efficiency to the removal of the absorptive substrate; the insertion of a metal reflector between the LEDs' structure and the copper submount; the elimination of electrode shading, which also reduces efficiency; and the rough surface of the exposed buffer layer, which improves crystal orientation on the substrate. The results are reported in a paper accepted for publication in the American Institute of Physics' journal Applied Physics Letters.

More information: "Crack-free InGaN multiple quantum wells light-emitting diodes structures transferred from Si (111) substrate onto electroplating copper submount with embedded electrodes" *Applied Physics Letters*.

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