

## **Low-cost high-efficiency GaN LEDs on large-area silicon substrates**

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GaN-based LEDs are already widely used in many applications, but they are not yet widely used for home and office lighting because of their cost. All commercial GaN LEDs are currently grown on small-diameter sapphire or SiC substrates. In this talk I will describe the growth of GaN LEDs on large-area silicon substrates.

Growing GaN LEDs on large-area silicon substrates is advantageous for a number of reasons. First, the device structures are compatible with silicon processing techniques using a silicon foundry. This should give improved automation and yield, and it will be much more efficient than the current “hand” processing on sapphire and SiC substrates. Second, large-area silicon substrates are significantly lower in cost than large-area sapphire or SiC substrates. Third, growth on large-area substrates makes more efficient use of MOCVD reactor space. Fourth is the ease of removal of the silicon substrates. However, growth of GaN LEDs on large-area silicon substrates is significantly more difficult than growing on sapphire or SiC. This talk will describe what the difficulties are, and how they can be overcome.

We have successfully grown flat, crack-free, GaN LED structures on 6-inch silicon substrates. The Internal Quantum Efficiency, measured by PL, of our structures is over 70%, and as good as our results for growing on 2-inch sapphire substrates. To exploit our technology we set up two companies. In February 2012 Plessey acquired these companies and it is now gearing up to bulk-manufacture GaN LEDs on 6-inch silicon substrates at its factory in Plymouth in the UK. Its plans are to manufacture 500 million of these LEDs per year, based on the technology of my research group.