Samsung researchers announce breakthrough in growing gallium nitride LEDs on glass

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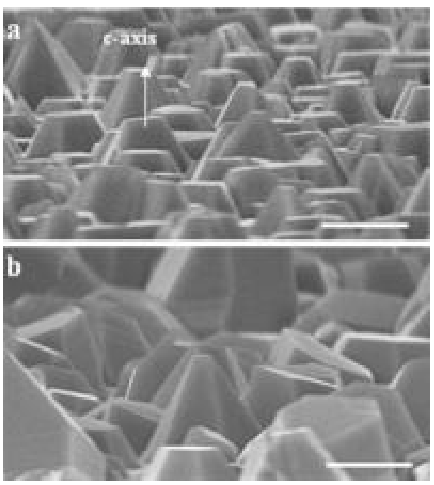

SEM images of GaN polycrystals grown on templates with LT-GaN/Ti/glass (a) and LT-GaN/glass (b). Scale bars are 2um. Image: *Nature Photonics*, doi:10.1038/nphoton.2011.253

(PhysOrg.com) -- Everyone knows that the LED market is huge, it’s among other things, the technology behind our big screen TVs. That’s why so many companies are investing so much money in trying to find ways to improve on it so that as our TVs get bigger, they won’t grow out of the average consumer’s price range. Now, Samsung, the Korean technology giant, has announced that one of its research teams has figured out a way to grow crystalline gallium nitride (GaN) LEDs on regular glass. They describe the process in their paper published in *Nature Photonics*.

Traditionally, LEDs have been grown on sapphire substrate or silicon wafer; both have their limits however, and thus, the idea of using glass to grow the LEDs is very attractive.

The new process is rather involved. It involves first laying down a bed of titanium metal on the glass to serve as a base template to help direct the growth of the GaN. Next, a very thin film of GaN (just a starter bit grown at a low temperature) is applied on top of the titanium metal. This will be the useful layer at the end of the process. After that, a sheet of silicon dioxide is applied over the GaN; it has very small holes in it that serve to direct how the crystals will grow as they come up through it. Rather like very tiny molds. The whole works is then subjected to very high temperatures to promote the crystal growth of the GaN. After that, the group says, the GaN can be processed using the same techniques that are used now with crystals grown on a sapphire or silicon.

While the process appears to be rather straightforward and uncomplicated, using standard materials and processes, it also appears, at least to some industry experts, to be time consuming, cumbersome, and because of the multiple steps required, too expensive to be used in a production type environment.

Samsung is undaunted however, stating that the new process opens the door to new ways of producing LEDs that will someday (perhaps ten years down the road) lead the way to such breakthroughs as regular window panes being used as LED devices, or the creation of oversized LEDs that could revolutionize giant screens such as those used in sports venues.

More information: Nearly single-crystalline GaN light-emitting

diodes on amorphous glass substrates, *Nature Photonics* (2011)
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Abstract
Single-crystalline GaN-based light-emitting diodes (s-LEDs) on crystalline sapphire wafers can provide point-like light sources with high conversion efficiency and long working lifetimes. Recently, s-LEDs on silicon wafers have been developed in efforts to overcome the size limitations of the sapphire substrate. However, to create larger, cheaper and efficient flat light sources, the fabrication of high-performance s-LEDs on amorphous glass substrates would be required, which remains a scientific challenge. Here, we report the fabrication of nearly single-crystalline GaN on amorphous glass substrates, in the form of pyramid arrays. This is achieved by high-temperature, predominant GaN growth on a site-confined nucleation layer with preferential polycrystalline morphology through local hetero-epitaxy. InGaN/GaN multiple-quantum wells formed on the GaN pyramid arrays exhibit a high internal quantum efficiency of 52%. LED arrays fabricated using these GaN pyramid arrays demonstrate reliable and stable area-type electroluminescent emission with a luminance of 600 cd m^{-2}.

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