Technology Commercialization Opportunity

Nanowire Light Emitting Diode integrated with Field Effect Transistor

Inventor(s):
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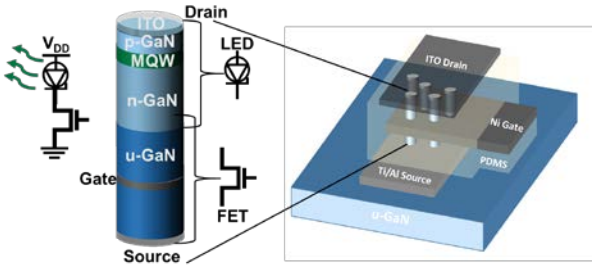

Technology Description:
Current display technology is reaching its practical limitations as the Thin-Film-Transistors (TFTs) that make up displays are struggling to be reduced further in size. Instead, nanowire Light Emitting Diodes (LEDs) are being pursued due to higher efficiencies (70% vs. 5-7%), high reliability, and the ability to be manufactured at the nanoscale. In this technology each nanowire can produce red, green, or blue light to compose a pixel. A number of companies are all pursing this technology due to the material advantages and cost savings. The issue is that there has been no easy way to integrate LEDs with transistors in order to control the displays. The current approaches sacrifice LED area, along with reducing device performance, limiting potential applications.

The approach here makes use of a previously unused layer of the LED, common to how LEDs are grown, in order to integrate a Field Effect Transistor (FET). The layer is unintentionally doped GaN which is grown before the main LED structure. Here, this allows for vertical integration of a FET without sacrificing device area. During processing, metal is deposited at the base of the wire and annealed. This creates an n-type region, where the FET then has a complete n-i-n structure common to modern transistors. Integration of the FET and LED does not negatively impact device performance and can boost light output through the use of insulating layers. These layers are used to build up the final device. Large scale arrays of wires can easily be fabricated allowing the rapid adoption of use in display technology.

Due to the transparent nature of GaN LEDs, this technology can be applied to heads-up displays for both civilian and military applications. The nanowire aspect additionally opens the door to flexible electronics through embedding the nanowires in a flexible polymer.

Keywords: Nanowire LEDs, Display, Flexible Electronics, AR, VR, GaN, InGaN

Technology Readiness:
Proof of concept has been demonstrated through the fabrication of vertical GaN nanowire LEDs with FET integration. Here an SIT version of the FET has been fabricated with an LED, though MOSFET integration is also possible. Simulation results have also been performed to model the performance.

Idea	Concept	Prototype	Alpha Version	Beta Version	Released

Intellectual Property:
Patent Pending

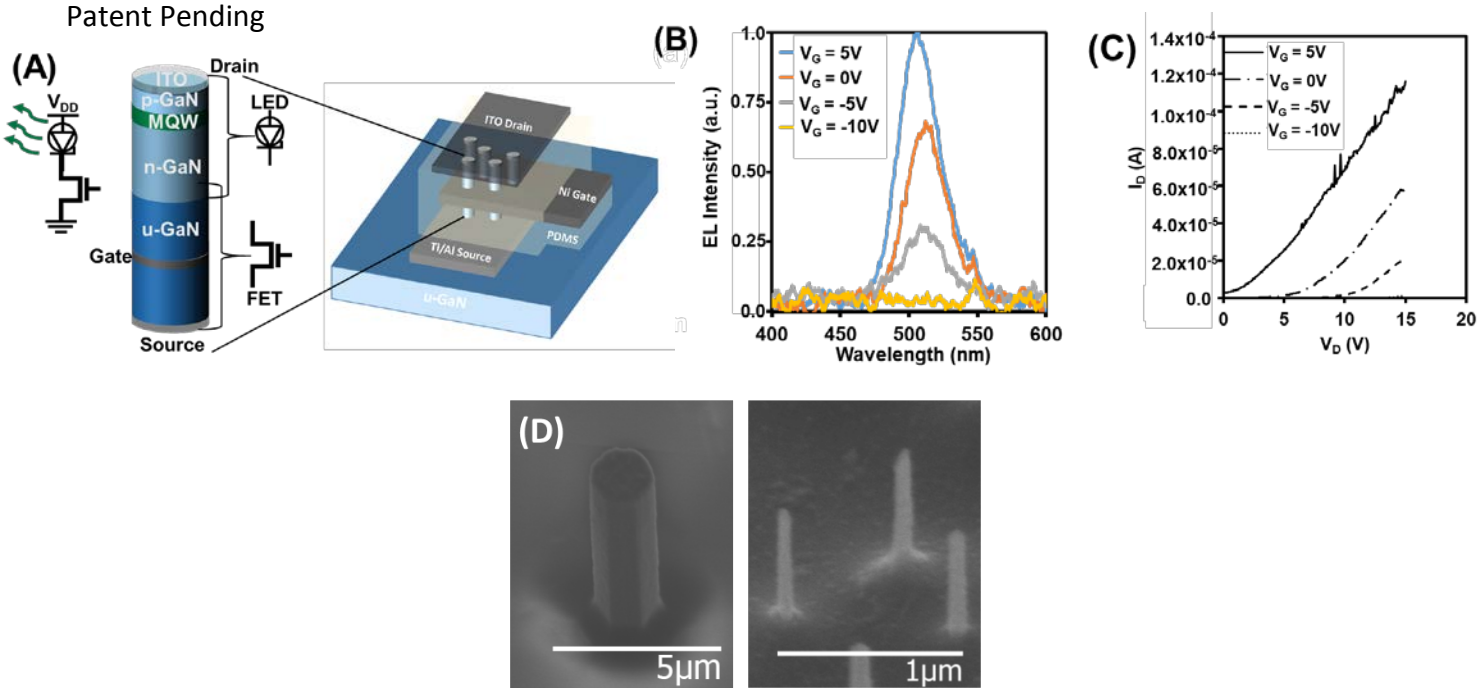

Fig A. Structure of Nanowire LED with FET, **Fig B.** Light intensity of nanowire LED increasing, decreasing, and turning off with FET, **Fig C.** Electrical results of device, **Fig D.** Separate samples at gate deposition step

Applications:

- Displays for TVs, Phones, Computers, Smart Watches, ect.
- Flexible displays
- Transparent displays for Augmented Reality

Target Customers:

- Display manufacturers
- Phone manufacturers
- Defense contractors
- Start-ups

Opportunity:
RIT's Intellectual Property Management Office (IPMO) is interested in working with those parties who are qualified and interested in the commercialization of the Nanowire Light Emitting Diode integrated with Field Effect Transistor technology. Arrangement types include licensing to existing organizations or new organizations that have expertise in the field or related fields. The inventors of the technology are available to work with licensees.

Contact:
Those interested in learning more about this opportunity should contact: Mr. William E. Bond, Director of Intellectual Property Management, at RIT (585) 475-2986 or bill.bond@rit.edu .

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