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TOPIC:

GaN Based Nano-wire Devices

ABSTRACT:

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GaN based devices have received a lot of attention for their immense potential for high power, radio-frequency (RF) and optoelectronics device applications [1,2]. While the superior material properties of GaN and their alloys prove to be beneficial to improve the characteristics of conventional devices, carrier confinement through reduced order (two- , one- and zero dimensional) structures can bring in additional advantages with exotic characteristics. We present our research works on GaN based nano wire transistor and light emitting diodes. Fig. 1 shows the hetero-structure used in our study for 1D transistor. The sample is treated with boiling H3PO4. Fig. 2 shows the nano-wire formed due to etching. Conventional nano-fabrication techniques are used to fabricate the transistor as shown in Fig. 3. The temperature dependent characteristic of these devices with various bias voltages will be presented. While the semiconductor/air interface provides confinement in one direction, AlGaN/GaN hetero- structure provides confinement in the other direction.

We have used similar methodology to fabricate nanowire LEDs. A schematic of the fabricated LED is shown in Fig. 4. An SEM image of the device and L-I characteristics are shown in Fig. 5. The photoluminescence (PL) and electroluminescence (EL) of these devices show 2D confinement. The EL characteristics are shown in Fig. 6. Detailed characteristics of these devices will also be presented.

PROFILE:

Academic Background:

- Ph. D., University of Michigan, 2005-2008.
- M. Tech., Indian Institute of Technology, Bombay, 2003-2005.

- Bachelor of Engineering, Jadavpur University, 1997-2001.

Research Interests:
Microelectronics, GaN Devices, New Device Physics Semiconductor Spintronics Spin injection, transport and detection in III-V systems, Device Reliability

Work Experience:
- Assistant Professor, Indian Institute of Technology, Bombay, India, 2009-Present.
- Intel, Portland, USA, 2008-2009.
- IBM, Kolkata, India, 2001-2003.