

III-Nitride nanowires: New materials for light emission

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Nanowires based on the III nitride (AlGaInN) materials system have attracted attention as potential nanoscale building blocks in LEDs, lasers, sensors, photovoltaics, and high speed electronics. Compared to conventional LEDs based on planar architectures, future LEDs based on III-nitride nanowires have several potential advantages which could enable cheaper and more efficient lighting. However, before their promise can be fully realized, a greater understanding of and control over their synthesis, properties, and device integration needs to be achieved. I will discuss research involving the aligned, bottom-up growth of Ni-catalyzed GaN and III-nitride core-shell nanowires, along with results providing insights into the nanowire properties obtained using cutting-edge structural, electrical, and optical nanocharacterization techniques. I will also describe a more recent “top-down” approach for fabricating ordered arrays of high quality GaN-based nanowires with controllable height, pitch and diameter (Fig 1). Using this top-down approach, both axial and radial nanowire device heterostructures can be realized. The fabrication, structure, optical properties, lasing characteristics, and performance of top-down-fabricated nanowires and nanowire LEDs and lasers will be discussed. Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy’s National Nuclear Security Administration under contract DE-AC04-94AL85000.

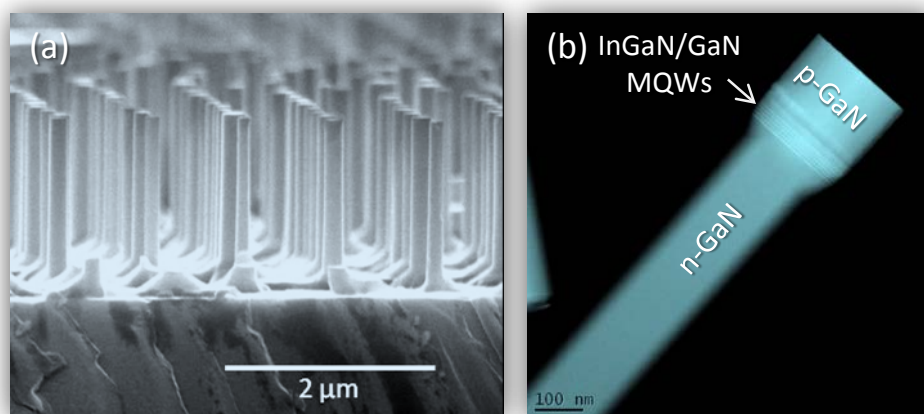


Figure 1. (a) array of top-down fabricated GaN nanowires; (b) single axial nanowire LED fabricated by top-down method.