



Review

III-Nitride nanowire optoelectronics

Songrui Zhao^a, Hieu P.T. Nguyen^b, Md. G. Kibria^a, Zetian Mi^{a,1}

^aDepartment of Electrical and Computer Engineering, McGill University, 3480 University Street, Montreal, Québec H3A 0E9, Canada

^bDepartment of Electrical and Computer Engineering, New Jersey Institute of Technology University Heights, Newark, New Jersey 07102, USA

Abstract

Group-III nitride nanowire structures, including GaN, InN, AlN and their alloys, have been intensively studied in the past decade. Unique to this material system is that its energy bandgap can be tuned from the deep ultraviolet (~6.2 eV for AlN) to the near infrared (~0.65 eV for InN). In this article, we provide an overview on the recent progress made in III-nitride nanowire optoelectronic devices, including light emitting diodes, lasers, photodetectors, single photon sources, intraband devices, solar cells, and artificial photosynthesis. The present challenges and future prospects of III-nitride nanowire optoelectronic devices are also discussed.

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E-mail addresses: zetian.mi@mcll.ca, zetian.mi@mcgill.ca (Z. Mi).

¹Tel.: +1 514 398 7114.

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1. Introduction

The first synthesis of gallium-nitride (Ga_N) was realized by Maruska and Tietjen at Radio Corporation of America Laboratories (Princeton, New Jersey, USA) using a hydride vapor-phase epitaxy process on sapphire substrate in 1969 [1]. Since then, tremendous efforts have been devoted to developing Ga_N-based optoelectronic and electronic devices. In 2014, the Nobel Prize in Physics was awarded to Profs. Isamu Akasaki, Hiroshi Amano, and Shuji Nakamura for their invention of Ga_N-based blue light emitting diodes (LEDs), which enabled efficient white light sources [2–4]. Today, Ga_N-based materials have been widely used in LED lighting, radio-frequency (RF) electronics, power electronics, and many others. For these reasons, III-nitride

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