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Abstract: An approach of growing crack-free GaN-based InGaN-multiple quantum wells (MQWs) with emission at 365 nm on AlN template, instead of conventional GaN template, by metal-organic chemical vapor deposition is presented. The AlN template used here was grown on the vicinal 2° misoriented sapphire substrate. Scanning electron microscopy and atomic force microscopy investigation showed that cracks do not form in the MQWs structure grown on an AlN template. The full width at half maximum of high resolution X-ray diffraction rocking curve of the n-$Al_{0.02}Ga_{0.98}N$ buffer decreases dramatically when grown on an AlN template, indicating improved crystalline quality. Moreover, Photoluminescence spectra show that the employment of AlN/2° misoriented sapphire template is beneficial to internal quantum efficiency and its thermal stability. Finally, transmission election microscopy reveals a prominent reduction of dislocation density at the undoped GaN/AlN interface.

Keywords: Gallium nitride; Indium gallium nitride; InGaAn multiple quantum wells; Aluminum nitride template; Crack-free; Optical property; Crystalline quality.

1. Introduction

III-nitride alloys are very suitable for applications of solid-state lights and lasers, power electronics, thermoelectricity and solar cells [1-3] due to its