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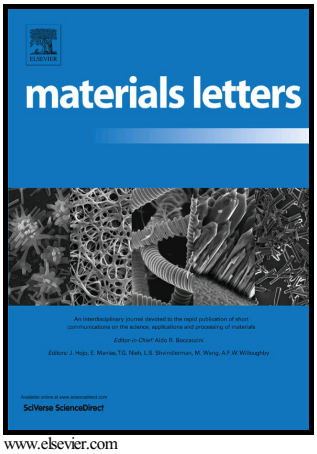

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Epitaxial growth of high quality AlN films on Si substrates

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Abstract:

Quality-enhanced AlN epitaxial films on Si substrates with Al buffer layer have been grown by the combination of molecular beam epitaxy (MBE) and pulsed laser deposition (PLD) technologies. MBE is deployed to grow Al buffer layer at first, and PLD is used to grow AlN epitaxial films on the Al buffer layer. It is found that as the increase in the growth temperature, the property of as-grown ~300 nm-thick AlN epitaxial films is first increased and then decreased, and shows an optimized value at 750 ºC. The as-grown ~300 nm-thick AlN epitaxial films grown at 750 ºC show full-width at half-maximums of AlN (0002) and AlN ($10\bar{1}2$) of 0.45° and 0.80°, respectively, a root-mean-square surface roughness of 1.4 nm. This work provides an effective approach for the growth of high-quality AlN epitaxial films on Si substrates for the future application of AlN-based devices.

Keywords: thin films; X-ray technology; morphology; structural; buffer layer

1. Introduction

III-nitride materials have been extensively used in power electronic and optoelectronic devices. In particular, AlN, which possesses direct wide band gap, outstanding piezoelectric as well as excellent thermal and chemical stability, has extended the application of group III-nitrides to high temperature and high power field [1,2]. To meet the need of AlN-based devices fabrication, high-quality AlN epitaxial layer is necessary.

Nowadays, epitaxial growth of III-nitrides on Si substrates has attracted considerable attention because of the potential