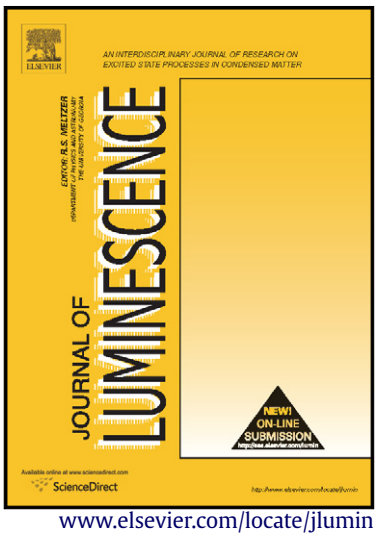

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Long-term transformation of GaN/Al_2O_3 defect subsystem induced by weak magnetic fields

Red'ko R.A.,[1] Konakova R.V.[1], Milenin V.V.[1], Shvalagin V.V.[2], Red'ko S.M.[1], Sveshnikov Yu.N.[3]

[1]V. Lashkaryov Institute of Semiconductor Physics of the National Academy of Sciences of Ukraine, 41 Nauky Pr., 03028 Kyiv, Ukraine; Tel. (*044*) *525-61-82; konakova@isp.kiev.ua, redko.rom@gmail.com*
[2]L. Pysarzhevskiy Institute of Physical Chemistry of the National Academy of Sciences of Ukraine, 31 Nauky Pr., 03028 Kyiv, Ukraine; shvalagin@mail.ru
[3]Elma-Malachite JSC, 124460 Zelenograd, Russia

Abstract

Long-term transformation of the optical transmittance and integral photoluminescence (PL) of GaN epitaxial structure under weak magnetic fields treatment (B=60 mT, τ=1.2 ms, t=5 min) were obtained. Optical and PL measurements were performed at 300 K in the wavelength ranges of 350-1100 nm and 350-650 nm, respectively. Non-monotonic changes of luminescence intensity accompanied by changes in optical thickness of layer that formed optical signal were observed. The correlations in extremes of obtained term-dependents were found. A method to estimate the diffusion factors of migrating defects in multilayer objects was proposed.

Keywords: Photoluminescence; optical transmittance; weak magnetic field; impurity-defect composition.

1. Introduction

The unexpected effect of improvement of the structural perfection of GaAs-based epitaxial layers and optical edge shift [1] have given impetus to research dealing with the influence of weak magnetic field (WMF) treatments on the spectral characteristics of widely used and promising material GaN. Its alloys with other III-N compounds are important semiconductor materials with applications to ultraviolet and visible portions of the spectrum for emitters, detectors and other electronic devices. The presence of numerous point defects and their complexes leads to impairment of useful parameters of already prepared device structures. So, WMF could serve as an alternative method for defect subsystem modification that can be applied at different production stages. The processes of WMF treatment of various materials were performed earlier by several research teams [2, 3]. Changes in mechanical properties of solids, phase composition of near-surface layers, surface roughness, emission intensities et al. have been detected after such processing. What is more, there were both reversible and irreversible effects.