

# Wet etching of RC LED heterostructures

Marianna Górska, Hanna Wrzeńska, Jacek Ratajczak,  
Jan Muszalski, Bohdan Mroziewicz, Maciej Bugajski

Institute of Electron Technology,  
Al. Lotników 32/46, 02 668 Warszawa, Poland  
muszal@ite.waw.pl

The Resonant Cavity Light Emitting Diodes are one of the noblest examples of devices fabricated by the modern nano-scale semiconductor technology. The possibility to control the layer thicknesses with the precision of a single nanometers offered by MBE combined with appropriate lateral patterning allows for enclosing the light source in a cavity of the dimensions comparable to the wavelength of emitted radiation. Such cavity called resonant cavity or microcavity strongly influences the emission characteristics. When a source is enclosed in a cavity the otherwise isotropic emission becomes strongly directional. Moreover the emission wavelength depends on the direction following the usual cavity dispersion relation [1]. This feature attracts the interest to RC LED devices. The proper construction of the device, i.e., tuning the cavity and the quasi-monochromatic light source can result in the enhanced quantum efficiency (the theoretical limit is 100% [1] for fully monochromatic source, experimental 20% for InGaAs quantum well in GaAs cavity [2]). It can also enhance the spectral purity of emitted radiation. The full width at half maximum (FWHM), if only registered in sufficiently narrow solid angle, can be as small as 1 nm. Such narrow emission lines have been observed so far only for the laser diodes.

In this paper we present the results obtained during the work on fabrication of RC LED devices. The devices were fabricated from molecular beam epitaxy (MBE) grown heterostructures. In those heterostructures the cavity was realised by placing a GaAs spacer layer in between two AlAs/GaAs distributed Bragg reflectors (DBRs). The AlAs/GaAs interfaces in those DBRs were composition graded using the digital alloy technique. A light source -three In<sub>0.2</sub>Ga<sub>0.8</sub>As quantum wells (3QW) was placed in the centre of the cavity. The goal of this work was to fabricate a mesa type device using the wet etching technique. Since same layer thicknesses in the digital alloy graded DBRs were as small as 0.56 nm the nonselective etchant had to be applied. The optimum etching conditions along with the etching depth control are described and analysed.

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