MASTER'S THESIS

Tunable wavelength from porous silicon-based devices

To, Wai Keung

Date of Award:
2009

Tunable Wavelength from Porous Silicon-based Devices

TO Wai Keung

A thesis submitted in partial fulfillment of the requirements

for the degree of

Master of Philosophy

Principal Supervisor: Prof. CHEAH Kok Wai

Hong Kong Baptist University

December 2009

Abstract

Two approaches were taken to fabricate wavelength tunable devices based on porous silicon. One was to control emission energy of erbium/ytterbium dependent on porous silicon by using a microcavity through fabricating multi-layer porous silicon beneath the doped layer.

Erbium/ytterbium doped porous silicon was found to emit efficiently from ultraviolet to near infrared [1]. The aim was to continue the previous research on erbium/ytterbium doped porous silicon. However, p-type silicon wafers were used to fabricate porous silicon instead of n-type silicon wafer. The reason was that multi-layer porous silicon can only be fabricated in p-type silicon and the porosity of the p-type porous silicon was more easily controlled than that in n-type porous silicon. This is a benefit in making microcavity.

Another was to have an enhancement and narrowing on a particular wavelength with the ability of tuning in porous silicon microcavity. The target wavelength can be adjusted without any change in the material used. This work can be divided into two parts. First part is to enhance and narrow a particular wavelength. Second part is to make the sample with the ability of wavelength selection.

To achieve the first part, microcavity is applied. Hence, patterned etching was applied to fabricate multi-layers for porous silicon distributed Bragg reflector as porous silicon was used. For the latter one, we did with the Bragg reflector. By controlling the etching current, the reflector produced was patterned. The high reflection wavelengths could be shifted by about 25nm.

Table of Contents