

國立交通大學

光電工程系顯示科技研究所

碩士論文

小型微型圓盤雷射在可撓式基版上的製程和特性分析

**Fabrication and Characterization of the Compact Microdisk
Lasers on the Flexible Substrate**

研究生：徐功書

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在此研究中，我們在可撓式基版上，研製了小型微型圓盤雷射，並分析彎折特性及在曲率光感測之能力。

首先，我們介紹小型微型圓盤雷射在可撓式基版上的製程技術，我們先利用電子束微影系統來定義小型微型圓盤共振腔的圖案，接著用感應式耦合電漿蝕刻系統和反應式離子蝕刻系統作為非等向性蝕刻的工具。除此之外，我們也利用掃描式電子顯微鏡來觀察及確定我們各製程步驟的結果。

為了量測並分析小型微盤雷射在可撓式基版上的特性，我們架設了一套長波長共焦顯微光譜系統。利用此系統，我們觀察並分析小型微盤雷射在可撓式基版上的共振模態及雷射激發模態，這其中包括了基本的雷射激發頻譜，光激發光輸出曲線。

最後，我們量測和分析小型微盤雷射在可撓式基版上彎曲後的雷射特性，其中包含了基本的雷射激發波長，雷射輸出能量，雷射臨界功率，雷射線寬，品質因子和偏極化率。在應用上，我們可以利用彎折後的小型微型圓盤雷射的特性來作為小型微型的曲率感測元件。

Fabrication and Characterization of the Compact Microdisk Lasers on the Flexible Substrate

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Abstract

In this thesis, the compact microdisk lasers on the flexible substrate are demonstrated. The fabrication of the microdisk lasers on the flexible substrate is introduced.

First, we define our microdisk cavities patterns by using electron-beam (E-beam) lithography system. The inductively-coupled-plasma (ICP) etching system and reactive ion etch (RIE) system are used to non-isotropic etch. Besides, we also use the scanning electron microscope (SEM) system to observe and check the results of each process steps.

We set up a micro-photo-luminescence (PL) system in order to characterize the microdisk lasers on the flexible substrate. The basic characterizations of the microdisk cavities on the flexible substrate are investigated including the resonance modes and lasing modes. The basic lasing properties are investigated such as lasing spectra and light-in light-out (L-L) curve.

Then, we also characterized the microdisk lasers on the flexible substrate after bending. The properties of a bent microdisk laser are investigated such as lasing wavelength, lasing power, threshold, line width, experimental Q and polarization ratio. In the application, we can use those characterizations of a bent microdisk laser to be a compact curvature micro-sensor.

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