論文摘要

隨著光儲存等應用系統中的光點不斷的縮小，對於光點品質的直接量測變得越來越困難。這種情況在利用近場光做記錄時更爲明顯，因爲光點的近場分布無法利用傳統的遠場成像等方法來量測。要量出近場光場的分佈，光感測元件必須放置於待測光場的近場範圍內，這種測量一般是利用近場光學顯微鏡來進行，但其缺點爲近場探針製作不易、系統複雜，而且解析度受限於探針的孔徑。因此，本論文將探討一種利用掃描刀緣法(scanning knife-edge method)，整合微機電系統中的梳狀致動器、奈米級平整度的刀緣結構以及光偵測元件來測量光點大小。

本文已成功利用包含 MUMPs 元件製作之含有掃描鏡面的致動器以及一外接光偵測放大電路之反射式刀緣掃描系統來驗證此概念。爲了提高量測系統的解析度，本文利用<111>矽基板微加工技術來製作一吸收式刀緣掃描系統。在此系統中，同一晶片上包含有梳狀致動器、奈米級平整度的刀緣結構以及光偵測元件，另外亦針對此晶片上的元件做一特性分析包含光二極體的響應度等。在研發吸收式系統的過程中，除了能夠開發新型光電元件及整合技術成一製程平台外，並能爲下一階段整合積體電路及微光機電系統而成爲微光電系統晶片(photonic system on chip, PSOC)的研發工作奠定良好基礎。

Abstract

As the optical spot size in applications such as optical data storage gets smaller, to measure the quality of the focused spot directly becomes more difficult. This problem is particularly prominent in near-field recording because the near-field optical distribution can not be measured with traditional far-field methods. To measure the near-field optical distribution, the detector must be placed in the near-field proximity. Presently these measurements are performed with near field scanning optical microscopes (NSOM). However, the shortcomings of this instrument include fragile probes, complex system and limit to the resolution by the probe aperture. Therefore, a microelectromachanical system (MEMS)-based knife-edge scanning method which integrated comb drive actuator, a smooth knife-edge plate and photo detector with amplifier is proposed to measure the optical spot size in the thesis.

A reflection type spot scan system, which contains a MUMPs actuator with scanning knife-edge reflective mirror and an external amplified photo detector were used to successfully prove the concept and sever as the prototype. To improve the resolution, <111> silicon substrate was adopted to fabricate the absorption type spot scan system. The system integrates a comb actuator, a smooth knife-edge plate and a photo detector into a chip. The characteristics of the devices in the chip such as the responsivity of the photo diode were measured. During the fabrication of the chip, not only a new type optoelectrical component but also a integration process platform was developed. Moreover, it can provide fundamentals for the integration of integrated circuits (IC) and optical MEMS in the next generation.

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