

中文摘要

隨著資訊科技的進步，高儲存密度及高速度的資料存取的需求也逐漸升高，而光儲存科技在其中扮演著相當重要的角色，其微型化及輕量化的應用也使得光儲存系統更具有競爭力，而微光機電系統正好是製造更小更輕的光儲存系統的方法之一。

微機電製程技術在半導體科技的進步之下日漸成熟，以其製作的微光學讀取頭乃是實現可攜式且高容量的關鍵技術之一，於本論文中所提到的微光學讀取頭是由微光學平台及可控式聚焦微透鏡所組成，其中的聚焦微透鏡正是本論文所研究的重點。

聚焦微透鏡有兩種，一種是繞射式微透鏡，其製作方法較為容易但是效率並不高，另一種是折射式微透鏡，其製程較困難而效率高。而由於灰階光罩技術的發展，折射式微透鏡開始於微觀世界中嶄露頭角，但是製程中尚有厚度上的考量，所以本論文所採用的是此兩種方式的混合體 Fresnel 透鏡，Fresnel 透鏡是一種結構特殊介於折射型與繞射型微透鏡間的光學元件。

灰階光罩有許多不同的光罩製作方式，因為微影製程簡單，近年來備受矚目，有半階光罩、HEBS 玻璃灰階光罩，而在本論文中所採用的是以聚焦離子束將圖案刻印於灰階光罩上的氮化矽，進而利用來製作微透鏡，而微透鏡設計的大小是 100 微米，其數值孔徑為 0.65。

本論文的最終目標是能以聚焦離子束光罩做出微透鏡，並且能達到至少直徑為 600 微米的大小，以利能實現製作成微光學讀取頭之聚焦微透鏡，來整合整個微光學平台。

Abstract

As the progress of information technology, the demand of high capacity and high speed is increasing. Optical data storage technology plays a key role. The application of miniaturization and lightness makes the optical storage system more competitiveness. And Micro-Opto-Electro-Mechanical System (MOEMS) is one of these methods.

MEMS fabrication technology matures by the progress of the semiconductor technology, and micro optical pick-up head fabricated by this technology is one of the methods to realize portable high capacity. In this thesis, the micro optical pick-up head is composed of a micro optical bench and a controllable focusing lens bonded together. The focusing lens is main study in this thesis.

There are two kinds of focusing lens, one is the diffractive type with simple process and low efficiency, and another is the refractive type with complex process and high efficiency. However, as the gray-scale mask progress, the refractive type becomes attractive in micro size. Cause of the limitation of thickness, the hybrid of these two types, Fresnel lens was used. The Fresnel is a special optical component between the refractive and diffractive type.

There are many different mask fabrication process in gray-scale mask, such as the half tone and High Energy Beam Sensitive (HEBS) glass gray-scale mask, and is attractive recently due to the simple lithography process. The gray scale mask to fabricate focusing microlens was made by FIB milling pattern on silicon nitride. The size of the design microlens is $100\mu\text{m}$, and the numerical aperture is 0.65.

Final target in the thesis is to fabricate microlens by FIB mask, and the size of microlens can reach at least $600\mu\text{m}$ in diameter. In order to realize the focusing microlens of micro optical pick-up head to integrate the micro optical bench.

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許英傑 謹識

中華民國九十四年十月

新竹 交大

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