以單晶鑽石刀具鉋削製作非球面微透鏡陣列之研究

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摘　要

近年來，由於光纖網路的普及化，人們對高頻寬網路的需求越來越殷切，使得廣泛應用於光纖網路傳輸模組中的關鍵零組件--微透鏡陣列成為炙手可熱的研究項目之一。

本論文主要是研究如何利用超精密加工機搭配天然單晶鑽石刀具，以鉋削加工方式製作出非球面微透鏡陣列，並探討刀具的切削角度對非球面微透鏡陣列的曲面形狀精度及表面粗糙度的影響，期望能夠找出在鉋削非球面微透鏡陣列時的刀具最佳切削角度，以增加透鏡的光學品質。

從本論文中的實驗結果得知，影響非球面微透鏡陣列形狀精度的最主要因素是刀具的面傾斜角的角度大小。而當刀具切削角與透鏡的法線向量在 80.7 度至 110.4 度，切線向量在 9.8 度至 20 度之間時，將可使鉋削完成後非球面微透鏡陣列的表面獲得粗糙度(Ra)<10nm 的滿意結果。

關鍵字：

鉋削、非球面微透鏡陣列、單晶鑽石刀具、表面粗糙度、形狀精度

Key word：

Shaping 、Aspherical micro lens array、Single crystal diamond tool、Surface roughness、Form accuracy

Study on the Shaping of Aspherical Micro Lens Array
Using Single-Crystal-Diamond Tool

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ABSTRACT

These years, due to the optical fiber network is popularizing, research and development of micro lens array, which is the key component of optical fiber transceiver module, becomes vital.

This thesis attempted to fabricate aspherical micro lens array by shaping process with ultra precision machine (4 axes) and single crystal diamond tool. Effects of cutting angles of diamond tool on the form accuracy and surface roughness of micro lens were investigated to find the optimum cutting angles of the tool for increasing the optical quality of the micro lenses.

According to the experimental results, the back rake angle of single crystal diamond tool is the most important factor to the form accuracy of aspherical micro lens array. When the back rake angle is between 80.7 and 110.4 degree, and the front clearance angle is between 9.8 and 20 degree, satisfactory results of lens surface roughness(Ra) which is less than 10nm can be obtained.

Key Word：
Aspherical micro lens array、Single crystal diamond tool、Shaping、Surface roughness、Form accuracy