ANALYSIS OF 8×8 SPOT CONVERTER OF VCSEL ARRAY MODULE USING MICROLENS ARRAY

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Abstract – *Analysis of the minimized physical size and increasing of optical coupling intensity are considered using 8× 8 VCSEL array and microlens array scaled to 4 mm² area.*

1. INTRODUCTION

Vertical cavity surface emitting laser (VCSEL)array is attractive for using in optical signal parallel transmission, enhancing data transfer speed and data storage density, and reducing the power heat dissipation [1]. Microlens array is an important role for focusing and collimating optical beam to increase optical power coupling efficiency between VCSEL and optical fiber array [2]. Based on increasing the power intensity and optical power coupling efficiency, many literatures have reported using array module for application in optical communication network [3,4]. In addition to coupling efficiency, it is an important issue that practical array modules have minimized physical size and low cost [5]. In this paper, We minimize the scale to millimeter square area for light coupling of 8× 8 VCSEL array with applying optical design software Zemax [6].

2. ANALYSIS

The schematic diagram of microlens array for spot conversion between VCSEL array and fiber array is shown in Fig.1. Integration of our proposed VCSEL array module consists of VCSEL array, microlens array and fiber array respectively. We can arrange the core pitch of microlens array to match the core pitch of fiber array then the various numerical aperture of optical device will be matched as microlens' radius is equal to 0.0625mm in this paper. In Fig.2, we show the power intensity image of 8× 8 microlens array after our simulation based on Fig.1 configuration. The simulated results of power intensity at fiber array end are compared with VCSEL array with or without microlens array as shown in Fig.3. We find out the optimum longitudinal offset of fiber array (Z_F) is almost 0.17 mm with microlens array located at 0.06 mm (Z_M) for maximum power intensity.. It is said that we can enhance the irradiance of at the fiber array from 119.98 to 157.73 Watt/cm² with or without our designed microlens array.

3. CONCLUSION

We have reported the analysis of the microlens array between VCSEL array and fiber array for minimize the physical size and integration of VCSEL array module. Optical power coupling efficiency is dependent on longitudinal offset of microlens array between VCSEL array and fiber array. In the near future, we are extending the results to realize our proposed array module fabrication and build up algorithm of auto-alignment for highly coupling efficiency.

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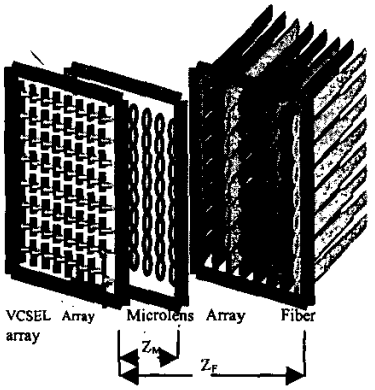

Fig.1 The schematic diagram of our proposed microlens array between VCSEL array and fiber array

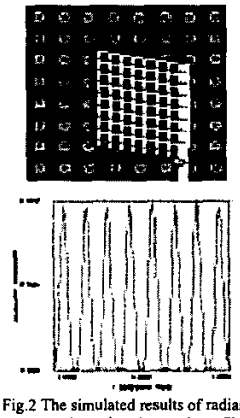

Fig.2 The simulated results of radiant intensity detected at fiber array end after microlens array focusing with VCSEL light array

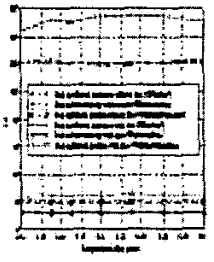

Fig. 3 The comparison of simulated results of tuning the longitudinal offset of fiber array (Z_F) and fixed microlens array (Z_M) at 0.06 mm between VCSEL and fiber array with or without microlens array

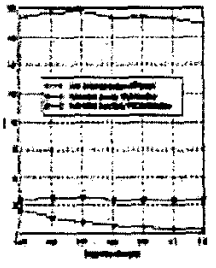

Fig. 4 The comparison of simulated results of fixing fiber array at 0.17 mm position (Z_F) and tuning the longitudinal offset of microlens array (Z_M) between VCSEL and fiber array

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