The Art and Science of Packaging High-Coupling Photonics Devices and Modules

（結合藝術與科學之高耦光元件與模組構裝）

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ABSTRACT

A new scheme of hyperboloid microlens (HM) employing automatic grinding and precise fusing techniques to achieve high-average and high-yield coupling efficiency from high-power 980-nm lasers into single mode fibers is proposed and demonstrated. The fiber endface of the HM exhibited a double-variable curvature in the major and minor axes which was characterized as a hyperboloid. By selecting half transverse length of the hyperbola and using fusing process to precise and quantitative controlling the required minor radius of curvature within 2.4 - 2.8 μm and offset within 0.8 μm, the HMs exhibited a high-average coupling efficiency of 83%. This study demonstrates that the proposed HMs through both automatic grinding and precise fusing techniques can achieve high-average and high-yield coupling efficiency better than any other grinding techniques to form asymmetric microlenses for utilizing in many low-cost interconnection applications. From art (or engineering) point of view, we are able to fabricate any kinds of perfect fiber microlenses.

Mode (spot size and phasefront) mismatch between the laser diodes and single-mode fibers (SMFs) can lead to a significant insertion loss. A direct near-field phase and intensity measurements in diode lasers, cleaved SMFs, and HMs are demonstrated by employing a SMF interferometer. From science point of view, detailed understanding of the near-field phase and intensity distributions of light sources and optical components may broadly benefit to provide practical micro-optic designs with better mode matching for interconnect applications.