"Aspheric nonimaging concentrators for multimode fiber coupling"

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ABSTRACT

Robust and efficient optical coupling from laser-to-fiber and from fiber-to-detector is an important consideration for loss limited optical data links. Standard chip scale package process flow used by the semiconductor industry is based upon machine vision assisted "pick-and-place" die attach and wirebonding operations. To realize scalable heterogeneous integration of optical elements, mass production must be done within the framework of existing manufacturing equipment and avoid active opto-mechanical alignment steps.

This publication reports on the performance of a set of a refractive, hemi-aspheric, nonimaging optical concentrators that are simple and amenable to standard package integration flow with passive alignment. A set of lenses are made by single-point diamond-turning and injection molding of unfilled polyetherimide, which is relatively transparent at the link operating wavelength of 850 nm. The goal of the design is to balance the absolute coupling at optimum alignment with wide margins for angular and linear misalignment.

Evaluation of the collection optics is accomplished with a scanning 20 micron diameter pinhole to measure the optical intensity in three dimensional space. Post processing of the resultant 3D data clouds yield equipower contour plots which are compared to simulated results. Further, the optics are evaluated for coupling of GaAs vertical cavity surface emitting lasers to high bandwidth multimode graded-index optical fiber made from perfluorinated amorphous optical polymer. Lastly, the reduction of coupling efficiency as a function of misalignment is evaluated and compared to simulated behavior.

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