Efficient resonant grating coupler for short distance optical interconnections

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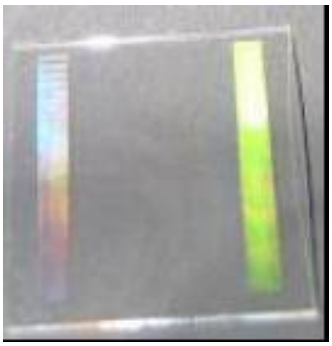
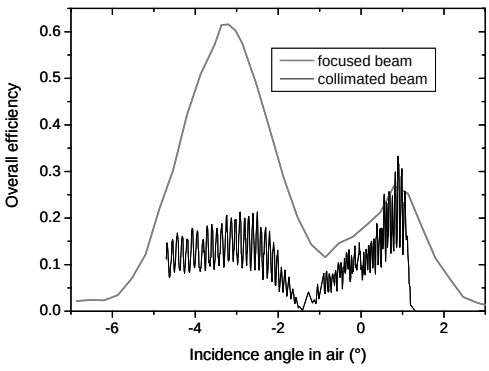
ABSTRACT

Coupling structures are key elements for short distance optical interconnections as they contribute significantly to determine the overall efficiency of the system. Although diffraction gratings have been thoroughly investigated as a means of coupling light between free-space and single mode optical waveguides in the past, their potential for optical interconnect applications involving multimode waveguides has not been widely considered yet. An original device has been designed for coupling a free space optical wave under quasi-normal incidence in- and out of- a highly multimode waveguide with minimum losses. It comprises two resonant diffraction gratings that are made of a shallow metal corrugation, covered with a high refractive index layer. The fabrication process is compatible with planar technology. The first experimental results demonstrate that the overall efficiency of the device is around 35 % with a collimated beam and reaches 60% with a focused input beam due to the optimized size of the input beam. Theoretical calculations show that optimised opto-geometrical parameters of the structure could lead to more than 70% overall efficiency. Experimental results compare favorably with results reported for 45° deflection micro-mirrors. Therefore, resonant gratings are well worth considering for short distance optical interconnections.



Top view of a 50 mm x 50 mm pyrex plate with two resonant gratings covered with a 50µm thick polymer waveguide



Overall efficiency measured at 850 nm wavelength as a function of the incidence angle in air