亚波长光栅器件
Sub-wavelength Blazed Grating Device

Introduction

The binary blazed grating is composed of sub-wavelength pillars with uniform height, which can be easily fabricated by only one etching step. The pillars' widths are modulated to obtain the blazed effect. It is found that this element substantially outperforms the conventional grating due to its high coupling efficiency and compact structure. Also, the polarization dependence of the grating is sensitivity, which is useful in the optical polarization splitting. Our work is to investigate the sub-wavelength grating device, such as coupler, polarization beam splitter, and beam splitter, and apply it in the optical integration.

Sub-wavelength blazed grating coupler

The binary blazed grating coupler exhibits excellent performance in fiber-to-waveguide/waveguide-to-fiber coupling, waveguide-to waveguide coupling, chip-to-chip vertical coupling, etc. The grating length is 14μm and coupling efficiency is 73%.

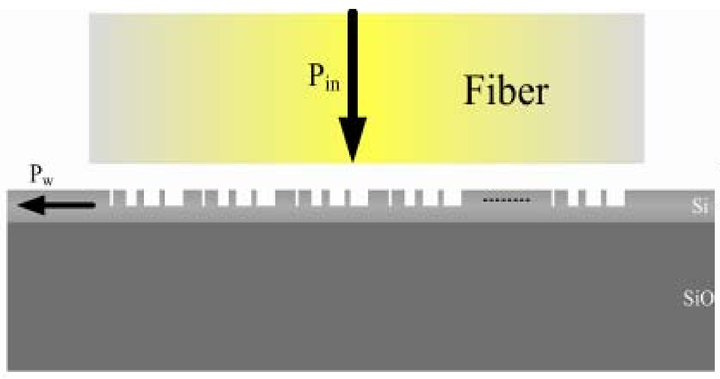

Fig.1 Schematic of grating coupler

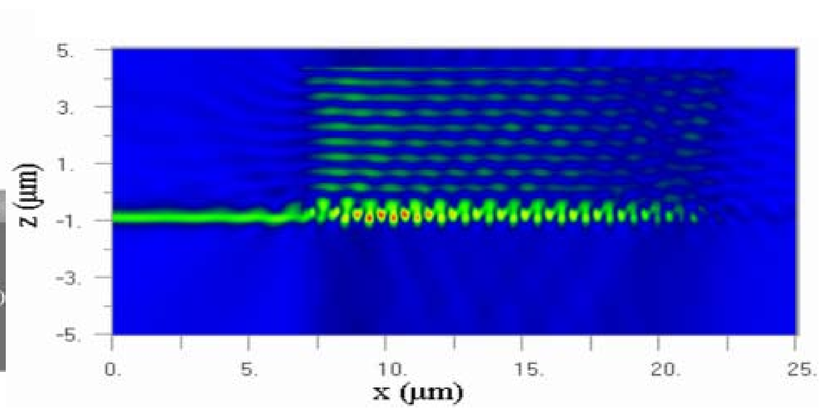

Fig.2 Simulation result

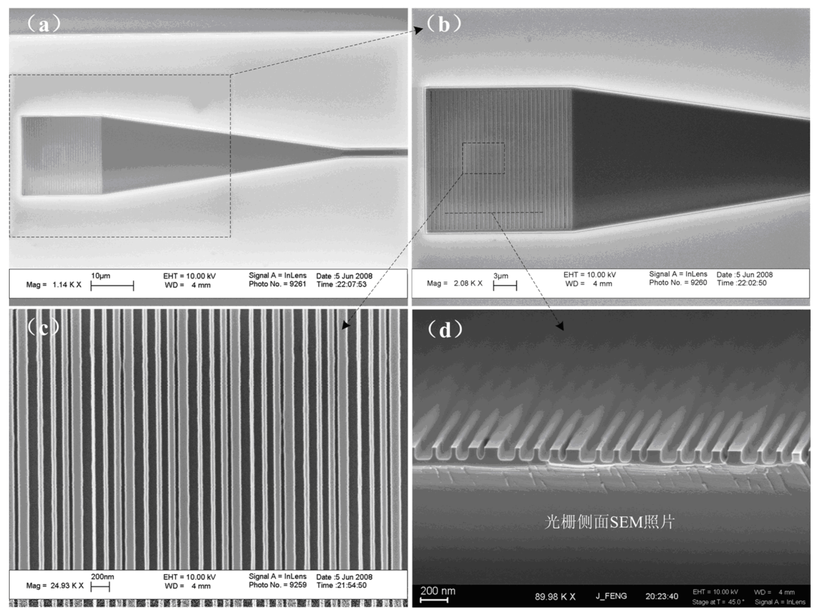

Fig.3 SEM images of the fabricated grating

Beam splitter

The device is normally illuminated by a monochromatic plane wave with TE polarized component. The TE polarized wave is then high efficiently separated into two beams by the device, which travel in opposite directions in waveguide. The coupling length is about 9μm. The coupling efficiency for the right and the left branches of waveguide are about 47% and 52%, respectively.

Parameters:

T=0.6μm; h=0.12μm;a=0.22μm; L=9μm

$\Delta_1 = 0.063\mu m; \quad \Delta_2 = 0.3\mu m$

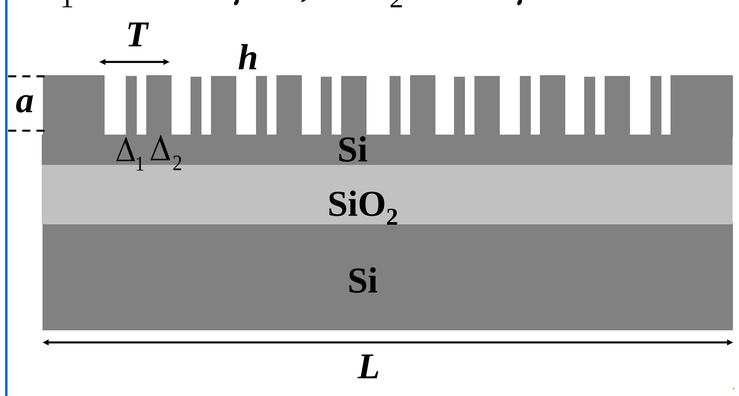

Fig.4 Schematic of grating BS

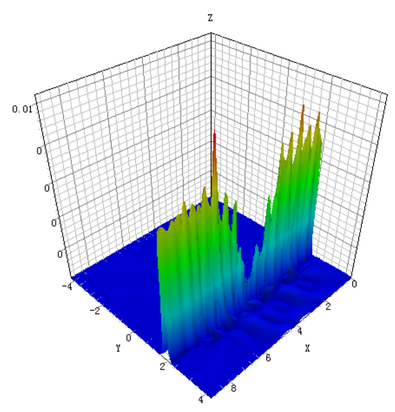

Fig.5 Optical field distribution

Conclusion

The sub-wavelength binary blazed grating for planar waveguide coupling and splitting is the most potential component, which has undergone a remarkable development in recent years, and offers important advantages including high refractive index contrast allowing a high integration scale, and CMOS compatibility. The whole structure can be easily fabricated by the mature fabrication processes and integrated with other optical functional device to form a compact system.

Publication

J. B. Yang, Z.Zhou, et al. Optics Letters, 36(6)(2011).

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