Metal Grating for Coupling to Photonic Crystal Circuits

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Silicon-on-Insulator (SOI) is a very interesting platform for high-density photonic circuits using photonic crystal waveguides and components as basic building blocks [1]. Integration of metal structures into the platform offers opportunities to increase the functionality of these circuits for various applications including telecommunication applications, chemo- and biosensing, NEMS/MEMS, etc. In this paper, we discuss the design and fabrication of metal gratings for out-of-plane but efficient coupling from an optical fiber to SOI-waveguides. These structures should be used in conjunction with in-plane couplers such as tapers for coupling to photonic crystal waveguides. Our calculations show that fiber-to-waveguide coupling efficiencies of 60 % at a wavelength of 1.55 μm can be obtained when periodically structuring a thin silver layer on top of the silicon waveguide layer. This is much higher than currently obtained by standard SOI grating couplers defined by shallowly etching in the silicon waveguide layer. The good optical properties and ease of fabrication of metal gratings offers great potential for very efficient, broadband and alignment-tolerant coupling to photonic crystal structures.

[1] W. Bogaerts, D. Taillaert, B. Luyssaert, P. Dumon, J. Van Campenhout, P. Bienstman, D. Van Thourhout, R. Baets, V. Wiaux, S. Beckx, Basic structures for photonic integrated circuits in Silicon-on-Insulator, Optics Express, 12(8), p.1583-1591 (2004).

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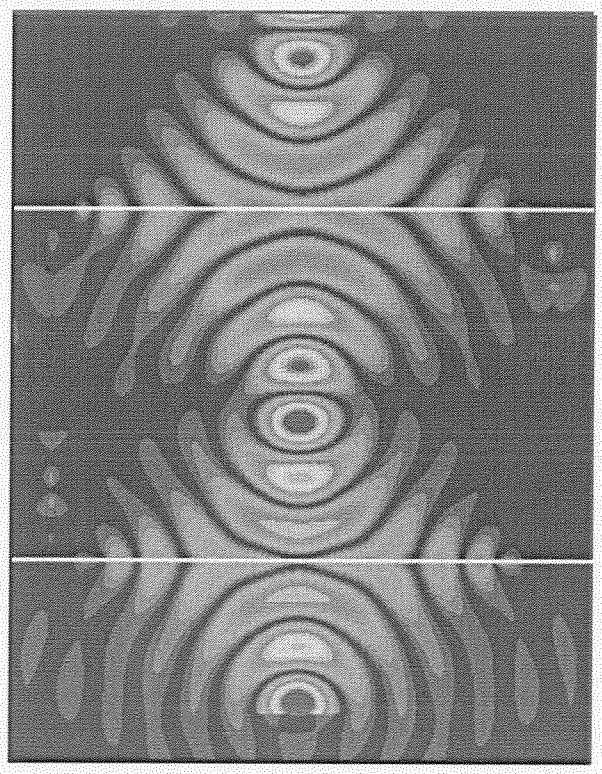

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