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论文

单光子晶体界面介质波导中的慢光效应

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摘要：

研究了单光子晶体界面介质波导中的慢光效应.芯层-空气层界面的全内反射效应以及光子晶体基底的禁带效应共同形成了对光场能量的横向约束.用基于超元胞的平面波展开法计算得到了导模色散曲线，并据此对其色散、群速以及群速色散性质做了详尽分析.由于利用了色散曲线慢光区域内拐点附近低群速色散的部分，该单光子晶体界面介质波导具有良好的慢光特性.对两个不同导模计算得到的平均群速分别为c/98和c/376，可用相对频带宽度分别达到2.1×10－3和4.1×10－4.另外，该慢光结构可以侧向耦合的方式克服光子晶体慢光波导耦合困难的缺点.

关键词： 光子晶体 慢光 介质波导 群速色散

Slow Light Effect in a Dielectric Waveguide of a Single Photonic Crystal Interface

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Abstract:

Slow light effect in a dielectric waveguide of a single photonic crystal interface was investigated.The combination of the total internal reflection at the core-air interface and the photonic band gap effect of the photonic crystal substrate forms the transverse confinement of the guided modes.Dispersion curves for these modes were calculated by a plane wave expansion method based on supercell,and we analyzed the properties of dispersion,group velocity and group velocity dispersion (GVD) in details.The structure shows good properties for slow light purpose,since the low GVD property of the dispersion curves near the inflection points in the slow light region was used.Calculated average gorup velocity for two different guided modes reach values of c/98 and c/376,and the corresponding normalized bandwidth are 2.1×10－3 and 4.1×10－4,respectively.Furthermore,it may overcome the difficulties in the coupling of slow light photonic crystal waveguide by the side coupling method.

Keywords: Photonic crystal Slow light Dielectric waveguide Group velocity dispersion

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