

量子光学

含一缺陷层的一维液晶填充光子晶体缺陷模电场和温度调控特性

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摘要: 基于液晶折射率对温度和电场的特性, 采用传输矩阵法, 研究了含一缺陷层一维液晶填充光子晶体缺陷模的电场和温度调控特性。研究表明: 当温度 T 在(273k, 340k)内一定时, 随着垂直入射光与电场方向间夹角 θ 在(0, $\pi/2$)内增大, 缺陷模波长向短波方向漂移, 最大调控波长为373 μm 。当夹角 θ 在(0, $\pi/2$)内一定时, 随着外界温度 T 在(273k, 340k)内升高, 缺陷模波长发生改变, 变化量先负后正, 最大调控波长为219 μm 。当 $\theta=0.7505$ 时, 不管外界温度 T 在(273k, 340k)内如何变化, 缺陷模波长保持不变。温度对缺陷模波长的影响比垂直入射光与电场方向间夹角 θ 对缺陷模波长的影响更弱。

关键词: 光电子学 缺陷模 传输矩阵法 可调光子晶体 液晶

Tunable defect mode by temperature and electric field in one dimensional liquid-crystal-filled photonic crystal with a defect layer

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Abstract: Based on the characteristics of liquid crystal index on electric and temperature, electric field and temperature controlled characteristics of defect mode were researched in one dimensional liquid-crystal-filled photonic crystal with a defect layer by means of transfer matrix method. The results showed that, as the temperature T is in the range from 273k to 330k, the wavelength of defect mode shifted to short wavelength and its variation increased with the increase of the angle θ between perpendicular incident light and electric field direction, which is in the range from 0 to $\pi/2$, and the maximum controllable value of wavelength is 373 μm . As the angle θ is in the range from 0 to $\pi/2$, the wavelength of defect mode will drift, the quantity of the drift is negative at first, and then positive with rising of external temperature T which is in the range from 273k to 330k and the maximum controllable value of wavelength is 219 μm . When θ is equal to 0.7505, no matter how to change the external temperature T which is in the range from 273k to 330k, the defect mode wavelength remains stable. The effect of temperature on the defect mode wavelength is weaker than that of the angle θ between perpendicular incident light and electric field direction on it.

Keywords: optoelectronics defect mode transfer matrix method tunable photonic crystal liquid crystal

收稿日期 2012-05-18 修回日期 2012-08-13 网络版发布日期 2013-05-10

DOI:

基金项目:

National Natural Science Foundation of China (61067002) and the Key Laboratory of Optoelectronic & Telecommunication of Jiangxi Province (2011007) .

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