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理论研究

一维光子晶体结构参数对禁带带隙的影响研究

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摘要 采用平面波法(PWM)
计算一维光子晶体的带隙结构。分别就构造一维光子晶体结构的高低折射膜层的介电常数及填充比
(高折射膜层的厚度与晶体周期长度的比值)
对禁带带隙宽度的影响作出分析。通过最小二乘曲线和曲面拟合得到带宽与介电常数或带宽与填充比的函数关系图，以确定最佳的禁带带宽，从而设计一维光子晶体的周期结构。对高低折射膜层为GaAs/空气组成的一维光子晶体，介电常数比约为13/1，当填充比为0.16时，计算得禁带带宽为0.2564×2πc/Λ，禁带的中心频率为0.3478×2πc/Λ，与实验数据吻合。

关键词 平面波法 光子禁带 带隙宽度 最小二乘曲线和曲面拟合

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Effect of structural parameters of one-dimensional photonic crystal on forbidden band gap

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Abstract The bandgap structure of one-dimensional photonic crystal was calculated and derived with the plane wave method (PWM). The effects of the dielectric constants of high/low refractive films making up one-dimensional photonic crystal structure and filling ratio between thickness of high reflective film and crystal period on the bandwidth of forbidden band gap were analyzed. The function relation between bandwidth and dielectric constants or the function between bandwidth and filling ratio was obtained by least square curve and curved surface fitting to make sure the best value of bandwidth, and to design the periodic structure of one-dimensional photonic crystal. For a one-dimensional photonic crystal with dielectric constants of 13/1 and filling ratio of 0.16, its calculated bandwidth is 0.2564×2πc/Λ and central frequency is 0.3478×2πc/Λ. These results agree with experiment data.

Key words plane wave method photonic bandgap bandwidth least square curve and curved surface fitting

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