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激光与光电子技术应用

平面波展开法在质量分数测量上的应用研究

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摘要： 为了提出测定果糖质量分数的新方案，采用光子晶体平面波展开法进行了理论分析和数值模拟。通过研究以硅半导体材料为背景介质周期性排列空气孔圆柱构成的光子晶体，分别取得了正方晶格和三角晶格的空气孔结构光子晶体的TE模、TM模禁带结构特性。结果表明，在高频率区域，2维正方晶格或三角晶格结构各向同性光子晶体的光子带隙随待测质量分数不同是单调变化的；同时，晶格结构对光子带隙有一定的影响，不论是在正方结构还是三角结构光子晶体中，TE模带隙都比TM模大得多。这对质量分数测量和高血糖患者的临床应用有一定的指导作用。

关键词： 材料 光子带隙 平面波展开 质量分数 果糖

Application of plane wave expansion method in measurement of mass fraction

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Abstract: In order to propose a novel method to measure the mass fraction of fructose, plane wave expansion method for photonic crystal was adopted. A 2-D photonic crystal with a square

lattice and triangle lattice of circular cylinders was designed in the Si background semiconductor material. The TE mode and TM mode band gap structure characteristics of square lattice and triangular lattice air hole structure photonic crystal were achieved.The results show that for isotropic photonic crystal of either square or triangular array arrangement, it is easier for the dielectric air type photonic crystal to form TE-polarized mode band gap in high-frequency region. Lattice structure has a certain impact on photonic band gap, TE mode band gap is much larger than the TM mode in both square and triangular structure photonic crystal. The photonic band gap changes with the difference of the mass fraction of the fructose solutions, which are used as the dielectric material in the air hole.

Keywords: materials photonic band gap plane wave expansion mass fraction fructose

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