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聚合物电光调制器中M-Z波导TM模分析

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摘要 M-Z光波导是聚合物电光调制器的重要结构单元。利用有效折射率法计算聚合物脊形波导的横向折射率分布，将三维光波场传播简化为二维传播。从导模满足的标量波动方程出发，结合透明边界条件，采用Crank-Nicholson差分格式，得出有限差分束传播法的基本计算格式。通过对M Z型波导结构中TM模的传播及损耗特性进行理论分析，系统地研究了脊宽、分支角等结构参数对损耗的影响。研究表明，有效折射率法与二维有限差分束传播法的结合可以较好地解决脊形M Z波导的设计问题。该方法具有精度高、计算量小及效率高等优点，为聚合物电光调制器的制备提供了理论依据。

关键词 电光聚合物 Mach-Zenhder波导 TM模 有限差分束传播法 有效折射率法
分类号

TM mode analysis of Mach-Zenhder waveguidein electro-optical polymer modulators

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Abstract Mach-Zehnder optical waveguide is an important component unit in electro optic polymer modulators. By using effective index method (EIM) to calculate the transverse refractive index distribution of polymeric ridge waveguide, 3 D light wave field propagation is successfully simplified into 2 D propagation. Proceeding from the scalar wave equation observed by the guided modes, the basic computing scheme of the finite difference beam propagation method is obtained by utilizing the transparent boundary condition (TBC) and the Crank Nicholson difference scheme. The effect of structure parameters such as ridge width and branch angle on the loss was theoretically studied with the support of the theoretical analysis of the TM mode light wave propagation and loss characteristics in the M Z waveguide structure. The combinational approach of EIM and 2D BPM demonstrates that the design of M Z waveguide can be made effectively by evaluating the influence of the structural parameters on the loss characteristics. The approach has high precision, small calculation complexity and high efficiency, and it provides a theoretical basis for the fabrication of electro optical polymer modulators.

Key words electro-optical polymer Mach-Zehnder waveguide TM mode FD BMP effective index method

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