耦合型異質接面光子晶體波導分光器設計與特性

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摘要

在本篇論文當中，我們希望可以設計出一個較短且具有高傳輸光子晶體分光器，因此首先我們利用二維平面波展開法計算出光子晶體波導的能帶圖；這個有效的計算方法可以幫助我們做出最佳的光子晶體波導設計，並且把設計應用在製程中。接者我們利用耦合理論計算出我們設計結構所需要的耦合長度，希望可以在最短的長度而得到最大的傳輸效率，而耦合型異質接面光子晶體波導分光器可以幫助我們達到這個需求，能在較短的耦合長度得到較大的傳輸效率。最後我們也利用有限時域差分法模擬出光波在光子晶體中傳輸的情形，我們利用這個方法可以找到在耦合異質接面光子晶體波導中最大傳輸效率所對應的波長。

在論文的最後，我們針對所做出的”單一缺陷光子晶體波導”進行量測，量測的結果與模擬有部分的相似，這是我們初步所量測到的成果。

Design and characteristic of coupling-type hetero-structure photonic crystal waveguide power splitter

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Abstract

In this thesis, the goal is to design a short length and high power transmission photonic crystal power splitter. At first, the simulation is performed by using two-dimensional plane-wave-expansion (PWE) method to calculate the band diagram and the defect mode. According to the simulations, we can find the optimized structure, and the fabrication of the structure is introduced. Then, the coupling mechanism is used to calculate the coupling length. And the coupling-type hetero-structure photonic crystal waveguide power splitter is good choice to get high power transmission and short coupling length. Finally, we use finite-difference time-domain (FDTD) method to simulate the wave propagation in the photonic crystal waveguide power splitter. Hence the power transmission versus wavelength is obtained, and we can find the maximum power transmission and the corresponding wavelength in this structure.

We measured the single-line defect photonic crystal waveguide with r/a ratio 0.3. Initial measurement results are obtained, and we can find some agreement between the measured data and the simulation result.

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