光波導分光元件結構之設計與模擬

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ABSTRACT

光通訊發展至今，運用高密度分波多工技術來倍增頻寬已成為主流，光通訊元件的需求量也將遽增，其中扮演將光纖的訊號分光與耦合的波導式的分光元件，在未來勢必扮演更重要的角色。 本論文探討分光元件中波導式分光器的設計，由於光訊號在波導中的傳輸過程中，包含了波導模態，模態的耦合，損失以及增益等。其他如幾何形狀、波長、初始光場分佈、材料的特性等，牽扯到複雜的運算，為了節省計算的時間，可利用BPM_CAD軟體進行模擬光波導之光路結構。設計上，主要是探討波導的結構對元件的影響，在考慮製程的難易度上，於分光光路間存在一空隙，以避免因製程的不穩定性而造成光路的誤差，而導致分光的不均勻度，此外為了降低元件的損耗，使用S-bend波導作為分光之光路結構，所考慮的是其曲率半徑變化較為緩慢，相對的也降低了因彎曲所造成的輻射損耗。目前已完成1×4、1×8分光器的設計，在其光場在輸出端之插入損失分別為低於6.5dB、11dB；且均勻度分別低於0.5dB、1dB。進一步設計1×16 分光器，損耗卻高達17db，比理論值大上許多，故這方面仍有待加強。 另外，在製程上是以火焰水解沈積系統沈積光波導膜，目前實驗已完成火焰水解沈積矽石波導層，於4吋之矽晶片上已可製作厚度均勻度3%，折射率均勻度0.1%之石英玻璃膜。相信再配合後續製程，即可達成元件製作之目標，以期能與模擬的結果相互對照。

Keywords : 高密度分波多工 ; 波導式分光器 ; 火焰水解沈積系統

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