閃頻式橢圓偏光儀的校正與誤差分析

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摘　要

閃頻式(stroboscopic illumination technique)橢圓偏光儀是利用觸發脈波產生器（pulse generator）調制雷射二極體的脈衝波來鎖定快速變化的光彈調變器四個相位來量測橢圓偏光參數，更可達到二維動態的量測 [1]。本文假設此架構的主要系統誤差來自於：(1) 初始時間相位的偏移 x。(2) 相位調變振幅 Δ_0。利用數據擷取卡 (DAQ card) 擷取波形取得一個週期的強度來運算並進行理論誤差分析。 並將閃頻式橢圓偏光儀的公式加以修正，可得消除系統誤差後的橢圓偏光參數。最後利用已知薄膜厚度的樣品來驗證此修正公式的正確性，並與傳統的倍頻分析法比較，此實驗可在 20 微秒內達 Ψ~0.03°, Δ~0.41° 之標準差。

Calibration and Error Analysis for Stroboscopic Illumination Ellipsometry

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Abstract

Stroboscopic illumination ellipsometry is a fast imaging technique which operates by synchronizing the ultra stable short pulse to freeze the variation of Photoelastic Modulator (PEM) signal. Four specific polarization states are used to deduce the ellipsometric parameters (Ψ, Δ). We postulate the main deviation of ellipsometric parameters in stroboscopic illumination ellipsometry is caused by the deviation of initial temporal phase and modulation amplitude. In this paper, we will derive a correction technique to optimize ellipsometric parameters. Finally, an optical thin film of known thickness was measured to demonstrate the reliability of this correction technique. We can eliminate errors caused by the miss positioned initial time and modulation amplitude deviation. This post flight measurement technique can eliminate all the system errors and achieve $\delta\Psi \sim 0.03^{o}$ and $\delta\Delta \sim 0.41^{o}$ in 20 μs.