表面電漿共振外差干涉儀的原理與其應用之研究

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摘要

當光經由表面電漿共振裝置反射後，其 p 偏光與 s 偏光間的相位差，會隨著相關的物理參數的變化，如：波長、濃度和折射率等，而產生急遽的變化；此相位差變化值可藉由外差干涉術精確地測量出。因此在本論文中提出一種結合表面電漿共振特性與外差干涉術的表面電漿共振外差干涉儀之架構，並將它應用於相關物理參數的量測。

由於此相位差值亦為表面電漿共振裝置中，金屬薄膜複數折射率與厚度的函數，所以本論文中也提出了使用旋光外差干涉術的測量方法，可在單一光學架構下高精確度地量測出金屬薄膜的複數折射率與厚度。

最後也探討了表面電漿共振裝置應用的最佳測量條件及其靈敏度。由於此干涉儀是具有共光程的架構，因此它同時具有共光程干涉儀及外差干涉儀的優點。

The principle of surface plasmon resonance heterodyne interferometer and its applications

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ABSTRACT

The phase differences between p- and s- polarizations of the reflected light at the boundary of a surface plasmon resonance apparatus vary rapidly with the variations of some physical parameters, such as wavelength, concentration, and refractive index, etc.. These phase differences can be measured accurately with the heterodyne interferometry. Consequently, the surface plasmon resonance heterodyne interferometer is proposed by combining the surface plasmon resonance effect and the heterodyne interferometry. It can be applied to measure related physical parameters.

The phase difference is a function of the complex refractive index and the thickness of the thin metal film of a surface plasmon resonance apparatus. An alternative method for measuring the complex refractive index and the thickness of the thin metal film is also proposed by using the circular heterodyne interferometry.

The optimal measurement conditions and the associated sensitivities with the surface plasmon resonance apparatus are discussed. Because of its common-path optical configuration, it has the advantages of both a common-path interferometer and a heterodyne interferometer.