OPTICAL FABRY-PEROT SPECTROSCOPY FOR THE DETERMINATION OF LAYER PARAMETRES

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It is well known that the principle of Fabry-Perot interferometry is the basis for solving a whole series of practical and scientific problems. To obtain the detailed information about the physical parameters of films it is very important not only experimentally measure the spectrum of reflection, but also determine the phase spectrum. The latter, as we all know, is highly complicated in the experiment process. In the present paper a new approach to the possibility of determination of the reflected wave phase directly from the experimental measurement of the light reflection spectra by plane-parallel film is dicussed. This method widens considerably the possibilities of optical spectroscopy. Let us remark that the results mentioned below can easily be generalized on the other types of spectroscopy of reflection and transmission of any type of waves by plane-parallel medium.

The analysis of the well-known in optics formula for Fresnel amplitude of light reflection, which takes into account multibeam light reflections from the interface of free plane parallel layer, shows that tangent of the result reflected wave phase is equal to:

$$\tan\phi = \frac{1-\rho^2}{1+\rho^2}\cot an\left(\frac{\delta}{2}\right),$$ where

$\delta = \frac{4\pi n d}{\lambda}$, $\rho = \sqrt{\left[\frac{1-n}{1+n}\right]^2}$. The spectrum of reflected wave phase is determined directly from the spectrum of normal and oblique reflection as $\tan^2\phi = \left(\frac{R_{\max}}{R}\right) - 1$,

where $R_{\max} = \left(\frac{2\rho}{1+\rho^2}\right)^2$. Therefore tangents of phase ϕ and tangent of phase thickness δ are connected by the relation

$$\tan\phi \cdot \tan\frac{\delta}{2} = \frac{2n}{1+n^2}.$$