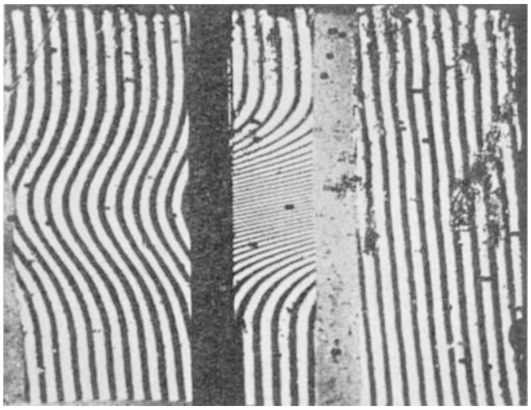

A_1–A_2 B_1–A_2 B_1–B_2

Fig. 2

difference between optical path-lengths along corresponding rays of s_1 and s_2 is constant. The arrangement of Wollaston prism and polarizer is essentially the same as that used by Lenouvel[2] as a wave-front shearing interferometer for determining the aberrations of optical instruments.

If the doubling angle φ is suitable, the two images of the cell will partly overlap. Let x and y be horizontal and vertical co-ordinates in the cell, and let $V(y)$ be the optical path through compartment A at height y; then, in the region where image A_2 overlaps image B_1, the bright fringes satisfy the equations

$$V(y) + \alpha x = \tfrac{1}{2}k\lambda, \quad (k = 0, \pm 1, \pm 2, \ldots) \qquad (1)$$

Thus the x-displacement of any fringe at height y is a linear function of the refractive index at y, so that the fringes in the A_2–B_1 region map the concentration in the cell.

If, in addition, W and P are turned through a small angle about the optical axis, the lateral separation δ between s_1 and s_2 will have a small vertical component, say, ε; then, in the region where A_1 overlaps A_2, the equations of the fringes will be

$$V(y+\varepsilon) - V(y) + \alpha x = \tfrac{1}{2}k\lambda, \; (k = 0, \pm 1, \pm 2, \ldots),$$

which can be written in the form

$$\alpha x = -\varepsilon\left\{\frac{V(y+\varepsilon) - V(y)}{\varepsilon}\right\} + \tfrac{1}{2}k\lambda. \qquad (2)$$

Thus, the x-displacement of any fringe is, for a small enough value of ε, a linear function of the gradient of the refractive index, so that the fringes in the A_1–A_2 region map the concentration gradient.

In both cases the constants of the linear relations in question are easily determined; the horizontal scale of the integral and gradient patterns can be varied together by moving W and P along the axis, while the scale of the gradient pattern alone can be varied by rotating W and P.

The fringe system can be photographed by placing a camera behind S'. The photographs in Fig. 2 show fringes obtained from a diffusion boundary; the straight fringes in the B_1–B_2 region indicate the direction of the base-line from which the x-displacement should be measured. The cell used was 1 cm. thick and the wave-length was 0·5461 μ, so that a displacement of one fringe corresponds to a refractive index increment of 0·000027.

The two images of S are recombined at S' in such a way that the fringe systems formed by the different points of S all coincide, so that no restriction on the size of the source is needed to obtain maximum fringe contrast. Such a restriction is needed only to ensure that the rays do not traverse the concentration gradient at too great an angle to the horizontal; the maximum permissible angle is obviously of the order of magnitude of h/t, where h is the vertical separation between successive fringes in the region of steepest gradient and t is the cell thickness. For work where the last condition is not important, the collimator and plane mirror could be replaced by a concave spherical mirror; also, modifications to suit different cell designs could easily be devised.

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[1] *Acta Chem. Scand.*, **5**, 1410 (1951).

[2] *Rev. Optique*, **17**, 350 (1938).

Thin Metallic Films for Anti-Reflexion Coatings on Dielectric–Air Interfaces

IN the course of some experiments with thin rhodium films, I noticed that the intensity of light reflected from a rhodiumized glass–air interface is much less than that reflected from the same interface when used in the air–glass sense. Sheared wave-front interferometric study of the edge of such a film indicated that this may be primarily due to a half-wave phase shift which can be seen at the glass–air boundary, but not when the same boundary is air–glass, the out-of-phase condition reducing the reflective intensity.

When the rhodium film had transmission factors exceeding 50 per cent the effect became so marked that the rhodiumized glass–air interface had reflexion factors markedly less than the uncoated portions of the same surface. By examining a continuously graduated coating it was established that the reflexion intensity is virtually zero when the transmission factor of the rhodium film is 70 per cent. This applies to glass having a refractive index about 1·52.

The reflected intensity was so low that microscopic examination of the surface by normal, bright-field vertical illumination resulted in a very striking dark-field image, dielectric particles and chemical film patches deposited on the surface appearing brightly illuminated against a black background. The chemical film patches and crystals produced interference colours markedly resembling those seen when viewing birefringent crystals in transmitted light between crossed nicols.

Although the transmitted light absorption and the uni-directional condition both impose severe limitations, the method may prove useful where all that is required is to prevent internal reflexions. It may be possible to improve the transmitted light intensity by using metals other than rhodium, though the latter seems the obvious choice for the microscope arrangement described above.

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