electric vector at an angle φ to the reflecting plane. After reflexion, a ray proceeds along MO with components of amplitude proportional to $\sin\varphi\cos 2\alpha$ and $\cos\varphi$, and polarized parallel to OX and OZ respectively. After diffraction at O, the X component will give rise to components of amplitude proportional to $-\sin\varphi\cos 2\alpha\sin\chi\sin\Upsilon_0$ polarized in the plane POZ and $\sin\varphi\cos 2\alpha\cos\Upsilon_0$ polarized perpendicular to this plane. The Z component gives corresponding components of amplitude proportional to $\cos\varphi\cos\chi$ polarized in the plane POZ and zero in the perpendicular direction. The intensity diffracted along OP is accordingly proportional to

$$(\cos\varphi\cos\chi-\sin\varphi\sin\chi\sin\Upsilon_0\cos 2\alpha)^2 + \sin^2\varphi\cos^2 2\alpha\cos^2\Upsilon_0 .$$

After averaging this result over all values of φ, to allow for the unpolarized nature of the rays incident at M, we obtain

$$\tfrac{1}{2}(\cos^2\chi+\sin^2\chi\sin^2\Upsilon_0\cos^2 2\alpha+\cos^2\Upsilon_0\cos^2 2\alpha) .$$

Since, by a well known result, the intensity incident at O is proportional to $\frac{1}{2}(1+\cos^2 2\alpha)$, the polarization factor is

$$P = \frac{\cos^2\chi+\sin^2\chi\sin^2\Upsilon_0\cos^2 2\alpha+\cos^2\Upsilon_0\cos^2 2\alpha}{1+\cos^2 2\alpha} . \quad (3)$$

The angles Υ_0 and χ are suitable film co-ordinates only in the normal-beam arrangement. In the inclined-beam arrangement suitable co-ordinates are μ, ν and Υ, where μ, ν are the inclinations of the incident and diffracted beams to the equatorial plane of the camera, and Υ is the azimuth of the diffracted ray defined in the usual way (Buerger, 1942, p. 297). It can then be shown by appropriate transformation of the axes of co-ordinates that

$$\cos\chi\sin\Upsilon_0 = \cos\nu\sin\Upsilon$$

and

$$\cos^2\chi = \cos^2\nu\sin^2\Upsilon+\cos^2\mu\cos^2\nu\cos^2\Upsilon+\sin^2\mu\sin^2\nu + \tfrac{1}{2}\sin 2\mu\sin 2\nu\cos\Upsilon ;$$

and hence, by substitution and rearrangement,

$$P = \{\cos^2 2\alpha+\cos^2\mu\cos^2\nu+\sin^2\mu\sin^2\nu + \cos^2\nu\sin^2\Upsilon(\sin^2 2\alpha-\cos^2\mu) + \tfrac{1}{2}\sin 2\mu\sin 2\nu\cos\Upsilon\}/\{1+\cos^2 2\alpha\} .$$

For purposes of numerical calculation this expression can be regarded as being of the form

$$P = A+B\sin^2\Upsilon+C\cos\Upsilon , \quad (5)$$

where A, B and C are constants for any given layer line recorded with a given camera setting.

By putting $\alpha = 0$ in the above expression we obtain

$$P = \tfrac{1}{2}\{1+(\cos\mu\cos\nu\cos\Upsilon+\sin\mu\sin\nu)^2\} \quad (6)$$

as a convenient form of the factor for unpolarized radiation in terms of the same co-ordinates. Expression (6) can of course be more simply derived by direct trigonometrical transformation from (1).

I wish to thank the Directors of Ferodo Ltd for permission to publish this communication.

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Notes and News

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