NEW METHODS OF REFRACTIVE INDEX DETERMINATION

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One of the most important characteristics for optical system designing is refractive index n. We suggest new methods of refractive index determination which are absolute and realized without complicated operations and equipment. New optical methods are used for non-destructive control of optical materials with different shapes of surfaces. They don't require any information about samples to be controlled.

The first new interference method of refractive index determination is used for transparent materials with varifom surface. In this case the order of interference depends on geometric co-ordinates. These equations for passing and reflecting light are :

$$k1 = 2(n-1)t(x,y) \quad \text{and} \quad k2 = 2nt(x,y) + 1/2$$

After calculation of derivatives, the refractive index is determinated by formula: $(dk1/dx)/(dk0/dx) = (n-1)/n = \Gamma$

Both interference pictures are similar and the index of similatiry is described Γ. So the determination of Γ-index also allows to calculate n by this formula.

For optical wedges we may use periods of interference b0 and b1 in these two pictures: $n = 1/(1-b0/b1)$

The second new autocollimative method has more simple realization, but it is used only for wedges. The sample is placed in front of the plane mirror in parallel light. After that we measure two values: light deviation after reflection from mirror $w2 = 2(n-1)\alpha$ made by a wedge and light deviation after reflection only from two sides of a wedge: $w1 = 2n\alpha$. The formula for refractive index is following $n = w1/(w1-w2)$.

The main point of third collimative method is based on measuring two light deviations w1 and w2, made by a wedge. The final formula is following $n = [w1 - w2]/[(2p+1)w1 - (2k+1)w2]$. Accuracy of collimative method raises by means of increase the number of light reflections (2p+1) and (2k+1) inside a wedge. Accuracy of these new methods is estimated in accordance with $(1 - 2) \times 10^{-5}$.

The device for implementation of these new methods has been designed in our Institute. We've measured refractive index of glasses and transparent plastics in visible and infra-red light ranges. The reasons to influence on accuracy of refractive index measurement by the methods are examined.

We suggest two new non-destructive interference methods for measurement of transparent plates thickness. They don't require any information about samples. Accuracy of these methods is estimated in accordance with 0,1 mkm.

0-8194-0732-1/92/$4.00