Dispersion of the Stress Optical Coefficient of the Alkali Halides

IN recent years the dispersion of the stress optical coefficients of diamond[1], the alkali halides[2] and magnesium oxide[3] has been determined in the visible range of wave-lengths. The dispersion in fused quartz[4,5] has also been investigated from 5700 to 2500 A. The observed dispersion is of the order of a few per cent for all these materials. In the present investigation the dispersion of the stress optical coefficient $C = n^3(q_{11}-q_{12})/2$ has been determined from the visible range to 2400 A. The method of measurement combines the differential feature of Bansigir and Iyengar's[2] method with the photo-
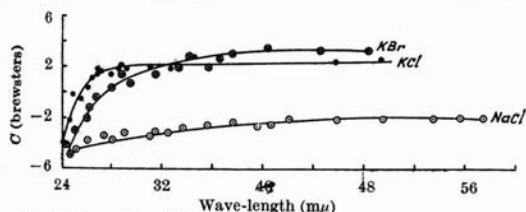

Fig. 1. Dispersion of the stress optical coefficient $C = n^3(q_{11}-q_{12})/2$ of three alkali halides

graphic method of Jog[6]. Using fused quartz (presented by the Thermal Syndicate to Prof. R. S. Krishnan) as the standard, the stress optical coefficient of the alkali halides is obtained by determining the position of the dark bands in the spectrum of light polarized at 45° to the direction of stress and passed through the fused quartz specimen loaded suitably, the stressed alkali halide crystal and an analyser in the crossed position. The position of the dark bands is determined by the equation :

$$C_1 W_1/t_1 + CW/t = n\lambda$$

where C is the stress optical coefficient of the material for wave-length λ ; W is the load applied on it ; t is its thickness and n is the order of the band. C_1, W_1 and t_1 refer to the standard and C, W and t to the alkali halide used.

In Fig. 1 are given the curves depicting C as a function of wave-length. As the method is differential, the accuracy in determining C is not very high. For sodium chloride, the mean square deviation of the experimental points from the curve is 0·16 brewsters while for potassium chloride and bromide it is 0·3 brewster. In Table 1 the values of $(q_{11}-q_{12})$ at 4800 A. determined in the present investigation are compared with the values in the literature.

Table 1. $(q_{11} - q_{12}) = 2C/n^3$ FOR THE ALKALI HALIDES (VALUES IN BREWSTERS)

Substance	Present value	Value in lit.	Reference
Sodium chloride	− 1·12	− 1·17 − 1·18	2 7
Potassium chloride	1·42	1·47 1·85 1·37	2 8 7
Potassium bromide	1·76	1·76 1·70 1·58	2 7 9

From the curves we see that : (1) in the visible region the dispersion is only a few per cent in agreement with the observations of Bansigir and Iyengar ; (2) as one approaches the ultra-violet, the dispersion becomes enormous ; for example, in sodium chloride C varies from −1·9 at 5800 A. to −4·5 brewsters at 2500 A., in potassium chloride from +2·4 at 5000 A. to −2·0 brewsters at 2450 A. and in potassium bromide from +3·4 at 4800 A. to −4·6 brewsters at 2450 A. ; (3) the curves for potassium chloride and bromide show that the stress optical coefficient for these crystals changes sign at 2550 A. and 2760 A. respectively. It therefore appears that these crystals which belong to Mueller's[10] class IV ($q_{11} - q_{12}$ +ive ; q_{44} −ive) go over to Mueller's class II ($q_{11} - q_{12}$ −ive ; q_{44} −ive Ex. sodium chloride) as one moves into the ultra-violet.

Further work is in progress, and the results will be published later.

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