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ON THE AXIAL LENGTHS OF PHLOROGLUCIN DIHYDRATE CRYSTALS

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ABSTRACT. The axial lengths of Phloroglucin Dihydrate crystals have been accurately determined. The values obtained are $a=6.740$ A.u., $b=8.090$ A.u., $c=13.604$ A.u. The axial ration determined from goniometric measurements of the crystal are $a:b:c :: .8334 : 1 : 3.366$. The density of the crystal is found to be 1.453 gms. per c.c

On examining the axial ratios of Phloroglucin Dihydrate crystal given in Groth's Chemische Kristallographie (Vol. IV, p. 80) and the ratios of axial lengths found from X-ray study (Banerjee and Ahmed, 1938) a discrepancy appeared which was much higher than the limits of accuracy usually attained in such experiments. So it was thought useful to repeat these measurements.

The axial lengths were measured from rotation and oscillation photographs in a cylindrical camera of diameter 8.3 cms. Both copper and iron K_α radiations from a Hadding tube were used for this purpose.

A small crystal was mounted successively with the three crystallographic axes parallel to the rotation axes by the help of a Czapski two circle theodolite goniometer. In order to eliminate uncertainties in the determination of the diameter of the camera due to want of axial symmetry of the camera if any, fine aluminium powder was dusted on the crystal. The diameter of the camera was thus determined accurately from the aluminium lines for each photograph separately. This also removes any error arising in the process of mounting the film in the camera.

To obtain the layer line distances, the distance between pairs of corresponding spots on two layers of the same order one above and one below the equatorial line was measured. Half of the mean of these distances was taken as the layer line distance for that order. The axial lengths were thus calculated separately from different layer lines for the three axes. The mean values of the axial lengths thus obtained were

$$a=6.744 \text{ A.U}, \quad b=8.093 \text{ A.U.}, \quad c=13.615 \text{ A.U.}$$

These values of the axial lengths were used for indexing the diffraction spots whose positions were accurately determined. Very accurate values of the axial lengths

were thus obtained. Very small crystals were used so that the diffraction spots were appreciably small. With the help of the calibrated diameter of the camera the angles of reflection of these spots were calculated. The results of the measurements are given in Table I where the first column gives the indices of the planes, the second gives 2θ, the third and the fourth give d and $\frac{1}{d^2}$ or $\frac{h^2}{a^2}+\frac{k^2}{b^2}+\frac{l^2}{c^2}$ respectively, whence a, b and c have been calculated.

TABLE I

Planes	2θ	d	$\frac{1}{d^2}$	Axial lengths		
				a	b	c
600	86°36′	2.122	793	6.733	—	—
006	30°39′	2.264	.195	—	—	13.589
080	99°5′	1.012	.977	—	8.096	—
008	69°15′	1.702	.345	—	—	13.616
00(10)	90°37′	1.361	.540	—	—	13.610
630	95°45′	1.039	.963	6.745	8.085	—
650	113°6′	.922	1.083			
390	124°48′	868	1.325	6.736	8.090	—
510	70°44′	1 320	.566			
401	54°45′	1.674	.357	6.746	—	13.595
400	51°19′	1 687	351			
402	56°7′	1.637	.373	—	—	13.615

Mean value of the axial lengths :—

$a=6.740$ A.U., $b=8.090$ A.U., $c=13.604$ A.U.

The crystals were also studied by a two circle theodolite goniometer. A few good crystals with well-developed faces were chosen and each was mounted successively with the three crystallographic axes vertical and the interfacial angle between the corresponding zone faces were measured by the horizontal circle. The mean values from the measurement of several crystals are given below :—

$$m : m\ (110) : (1\bar{1}0) = 79°32'$$

$$r : r\ (101) : (\bar{1}01) = 27°47'$$

The interfacial angles as quoted by Groth :—

$$m : m\ (110) : (1\bar{1}0) = 79°1'$$

$$r : r\ (101) : (\bar{1}01) = 27°8'$$

The axial ratio $a : b$ obtained from our measurement of the interfacial angle (110) : (1$\bar{1}$0) came out to be .8324 : 1

The axial ratio $b : c$ obtained from the interfacial angle (10$\bar{1}$) came out to be 1 : 3.366

Thus from the interfacial angles we have :—

$$a : b : c :: .8324 : 1 : 3.366$$

The axial ratios from the X-ray measurements are

$$a : b : c :: .8333 : 1 : 3.362$$

The ratios from the Groths' quoted values are

$$a : b : c :: 8261 : 1 : 3.1172$$

The density of the crystal was determined by Retger's suspension method from a solution of zinc sulphate in water. Very small particles from flawless crystals were used. Several observations were taken and the mean value of the density was found to be 1.453 gms. per c.c. The number of molecules per unit cell thus came out to be 4. The density of the crystal was also calculated from the mean value of the axial lengths determined by us and was found to be 1.442 gms. per c.c.

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REFERENCE

Banerjee and Ahmed, 1938, *Ind. Journ. Phys.*, **12**, 249.