Weissenberg and precession diagrams. Cu $K\alpha$ radiation was used ($\lambda = 1{\cdot}5418$ Å).

Cadmium sulphate ($CdSO_4$)

$$a_0 = 4{\cdot}709 \pm 0{\cdot}001,\ b_0 = 6{\cdot}562 \pm 0{\cdot}0015,$$
$$c_0 = 4{\cdot}694 \pm 0{\cdot}001\ \text{Å};\ V = 145{\cdot}05\ \text{Å}^3.$$

The axial ratios

$$a_0 : b_0 : c_0 = 0{\cdot}7176 : 1 : 0{\cdot}7153$$

are in fair agreement with those obtained from the crystallographic measurements

$$a : b : c = 0{\cdot}7190 : 1 : 0{\cdot}7165\ .$$

Mercuric sulphate ($HgSO_4$)

$$a_0 = 4{\cdot}821 \pm 0{\cdot}0005,\ b_0 = 6{\cdot}581 \pm 0{\cdot}0007,$$
$$c_0 = 4{\cdot}785 \pm 0{\cdot}0005\ \text{Å};\ V = 151{\cdot}83\ \text{Å}^3.$$
$$a_0 : b_0 : c_0 = 0{\cdot}7325 : 1 : 0{\cdot}7271$$
$$a : b : c = 0{\cdot}7328 : 1 : 0{\cdot}7258\ \text{(goniometrically)}.$$

For a unit-cell content of two units ($CdSO_4$) or ($HgSO_4$) densities of 4·757 and 6·487 g.cm.$^{-3}$ respectively are calculated, as compared with the values 4·691 and 6·470 g.cm.$^{-3}$ given in the literature (*Handbook of Chemistry and Physics*, 1958).

The only systematic extinctions are those of the $hk0$ reflexions when $h + k$ is odd.

Assuming from their appearance that the crystals are holohedral we deduce D_{2h}^{12}–$Pmmn$ as the most probable space group for both substances.

We wish to express our thanks to the Royal Hellenic Research Foundation for supporting our research program by donating a precession camera to our Department.

References

GROTH, P. (1908). *Chemische Kristallographie*, **2**, 383. Leipzig: Engelmann.

Handbook of Chemistry and Physics (1958). 40th ed., pp. 548, 608. Cleveland: Chemical Rubber Publ. Co.

Acta Cryst. (1961). **14**, 330

The lattice constants of some metal-fluoroborate hexahydrates.

By K. C. MOSS, D. R. RUSSELL, and D. W. A. SHARP, *Inorganic Chemistry Research Laboratories, Imperial College, London, S. W. 7, England*

(*Received* 15 *November* 1960)

Although it has been stated (West, 1935) that the fluoroborates, $M(BF_4)_2 . 6\ H_2O$ ($M = Mg^{2+}$, Mn^{2+}, Fe^{2+}, Co^{2+}, Ni^{2+}, Zn^{2+}, Cd^{2+}), are isomorphous with the corresponding perchlorates, none of their lattice constants appear to have been recorded. The lattice constants and measured and calculated densities are recorded in Table 1, where they are compared with the values obtained by West for the perchlorates. The Mg, Mn, Fe, Co, Ni, and Zn salts are hexagonal and are very similar in size to the corresponding perchlorates: the cadmium salts have a closely related trigonal structure with a one half of that shown in Table 1; the true value is doubled for comparison with the other salts. West has shown that the copper salts are not isomorphous with other divalent salts. Theory (Orgel & Dunitz, 1957) would predict a distortion of the octahedra of oxygen atoms about the Cu^{2+} ions.

Lithium fluoroborate exists in at least two forms. $LiBF_4 . H_2O$, stable above 23°, is tetragonal, $a = 5{\cdot}74$, $c = 4{\cdot}88$ Å. $LiBF_4 . 3\ H_2O$ crystallizes from aqueous solution below 23 °C. and is hexagonal, isomorphous with the corresponding perchlorate (West, 1935). The only phase that we could crystallize from such solutions is hexagonal, $a = 9{\cdot}90$, $c = 5{\cdot}53$ Å, but is not isomorphous with the perchlorate trihydrate.

The hydrates were prepared from solutions of the appropriate carbonates in fluoroboric acid. X-ray powder photographs were taken with a 9-cm. camera using Cu $K\alpha$, Co or Cr radiation.

Thanks are due to the Department of Scientific and Industrial Research (D.R.R.) and the Hertfordshire County Council (K.C.M.) for maintenance grants.

References

ORGEL, L. E. & DUNITZ, J. D. (1957). *Nature, Lond.* **179**, 462.

WEST, C. D. (1935). *Z. Kristallogr.* **91**, 480.

Table 1. *Lattice constants and densities*

	$M''(ClO_4)_2 . 6\ H_2O$				$M''(BF_4)_2 . 6\ H_2O$			
M''	a	c	Measured density	Calculated density	a	c	Measured density	Calculated density
Mg	15·52 Å	5·26 Å	1·981	1·99	15·36 Å	5·38 Å	1·849	1·85
Mn	15·70	5·30	2·102	2·10	15·46	5·44	1·982	1·98
Fe	15·58	5·24	2·147	2·17	15·49	5·33	2·038	2·02
Co	15·52	5·20	2·198	2·22	15·33	5·22	2·081	2·11
Ni	15·46	5·17	2·252	2·25	15·32	5·16	2·136	2·16
Zn	15·52	5·20	2·252	2·26	15·24	5·30	2·120	2·16
Cd	15·92*	5·30	2·368	2·38	15·96*	5·58	2·292	2·12

* See text.