

The structure of $TiCl_2$.* By N. C. BAENZIGER and R. E. RUNDLE. *The Institute for Atomic Research of Iowa State College, Ames, Iowa, U.S.A.*

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An investigation of the dihalides of titanium, vanadium and chromium has been reported by Klemm & Grimm (1942) in which they were unable to determine the crystal structure of $TiCl_2$. Those investigators stated that it was not isostructural with TiI_2 , which was found to have the CdI_2 ($C6$) type structure.

H. Lipkind has prepared $TiCl_2$ in this laboratory by the reduction of $TiCl_4$ with hydrogen in a heated quartz tube. The X-ray diffraction powder diagrams of this material can be interpreted with a hexagonal unit cell, $a = 3.561 \pm 0.005$ A., $c = 5.875 \pm 0.008$ A. The calculated X-ray density, with one $TiCl_2$ per unit cell, is 3.06 g.cm.⁻³ This is in fair agreement with the value 3.13 g.cm.⁻³ obtained by Klemm & Grimm by the pycnometer method. (There is a possibility that Klemm & Grimm did not have the same material.)

The intensities of the maxima have been calculated on the basis of the CdI_2 structure with

$$1 \text{ Ti at } 0, 0, 0;$$

$$2 \text{ Cl at } \pm \frac{1}{3}, \frac{2}{3}, u, \text{ with } u = \frac{1}{4}.$$

The calculated and observed intensities are listed in Table 1. Varying the u parameter from $\frac{1}{4}$ did not improve the intensity agreement.

It seems clear from the agreement between the calculated and observed intensities that $TiCl_2$ has the CdI_2 structure. The diffraction data of Klemm & Grimm, which do not agree with the above, may be evidence for another crystal form.

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The intensities were calculated using $I \propto FF^*LPMA$, where F is the structure factor; F^* its complex conjugate; L and P the Lorentz and polarization factors; M the multiplicity factor; and A the absorption factor. An artificial temperature factor obtained by plotting

Table 1. Intensity comparisons for $TiCl_2$

Indices	Intensities		Indices	Intensities	
	Calc.	Obs.		Calc.	Obs.
00*1	51	66	20*2	21	21
10*0	2.7	—	10*4	0.3	—
00*2	5.3	15	11*3	5.4	9
10*1	260	264	20*3	9.2	15
10*2	149	110	00*5	0.4	—
11*0	80	77	21*0	0.1	—
11*1	21	17	21*1	13	18
10*3	50	50	11*4	14	18
20*0	0.5	—	10*5	4.9	9
11*2	3.5	—	21*2	10	13
20*1	30	24	20*4	0.05	—
00*4	11	11	30*0	3.9	9

$\log I_{\text{obs.}}/I_{\text{calc.}}$ versus $\sin^2 \theta$ was used to bring the data into agreement over the whole range of the film. The intensities were estimated visually by comparison with standard intensity films. The lattice constants are given in true A. units; for the wave length of Cu $K\alpha$ radiation we have used 1.5418 A. (Bragg & Wood, 1947).

References

- BRAGG, W. L. & WOOD, R. A. (1947). *J. Amer. Chem. Soc.* **69**, 2919.
 KLEMM, W. & GRIMM, L. (1942). *Z. anorg. Chem.* **249**, 198.

Notes and News

Announcements and other items of crystallographic interest will be published under this heading at the discretion of the Editorial Board. Copy should be sent direct to the British Co-editor (R. C. Evans, Crystallographic Laboratory, Cavendish Laboratory, Cambridge, England).

Forthcoming publications

Messrs G. Bell and Sons Ltd., London, England, announce the forthcoming publication of the following works of crystallographic interest:

The Optical Principles of the Diffraction of X-rays. By R. W. JAMES, being vol. II of *The Crystalline State*. Probable price 80s.

Outline of Contents: The Geometrical Theory of Diffraction by Space-lattices; The Intensity of Reflection of X-rays by Crystals; The Atomic Scattering Factor; The Anomalous Scattering and Dispersion of X-rays; The Influence of Temperature on the Diffraction of X-rays by Crystals; Experimental Tests of the Intensity Formulae; The Use of Fourier Series in Crystal Analysis; Laue's Development of the Dynamical Theory—Kossel

Lines; The Scattering of X-rays by Gases, Liquids and Amorphous Solids; Diffraction by Small Crystals and its Relationship to Diffraction by Amorphous Matter.

Crystals and X-rays. By KATHLEEN LONSDALE. Price about 15s.

Outline of Contents: Historical Introduction; Generation and Properties of X-rays; The Geometry of Crystals; X-ray Methods of Investigation; Geometrical Structure Determination; Determination of Atomic and Electronic Distribution; Extra-Structural Studies; The Importance of the Study of Crystals.

Messrs Bell also announce the reprinting of *The Crystalline State*, vol. I, by Sir LAWRENCE BRAGG, and that H. LIPSON has in preparation a work on *The Technique of X-ray Analysis* which will probably constitute vol. III of *The Crystalline State*.

International Union of Crystallography

Statutes and By-Laws

The Statutes and By-Laws of the International Union of Crystallography, as adopted at the First General Assembly held from 28 July to 3 August 1948, are printed below. Copies of these Statutes and By-Laws may be obtained from the General Secretary (R. C. Evans, Crystallographic Laboratory, Cavendish Laboratory, Cambridge, England).

STATUTES

I. *Objects of the Union*

1. The objects of the Union are:
 - (a) to promote international co-operation in crystallography;
 - (b) to promote international publication of crystallographic research and of crystallographic works;
 - (c) to facilitate standardization of methods and of units in crystallography;
 - (d) to form a focus for the relations of crystallography to other sciences.
2. The Union is a member of the International Council of Scientific Unions.

II. *Membership*

3. In each country the Adhering Body is the National Academy, the National Research Council or similar institution, a Scientific Society or a group of such Societies, or finally an independent National Committee formed for the purpose of adhering to the Union. In each case a National Committee of Crystallography shall be formed, and admission to the Union shall be ratified when the membership of this Committee has been reported to, and recognized by, the General Assembly.

4. The term 'country' shall be understood to include Dominions, Colonies, Protectorates, any dependencies which budget independently for scientific purposes, and any group of independent States which agree to form a Joint National Committee of Crystallography.

5. Each country shall adhere to the Union in any one of eight Groups I–VIII with corresponding voting powers and contributions as set out in paragraphs 8 and 10. The Adhering Body of each country shall make known to the General Secretary before the opening of each General Assembly the Group adopted for the period to the next General Assembly.

6. An Adhering Body may select different Groups for participation in Special Projects which are under the control of Commissions or Joint Commissions of the Union and which are financed independently of the General Expenditure of the Union; or it may refrain from participation in such projects. Voting powers and contributions in respect of each Special Project shall correspond to the Group selected for that project as set out in paragraphs 8 and 10. The Adhering Body of each country shall make known to the General Secretary before the opening of each General Assembly the Group, or Groups, adopted in respect of Special Projects for the period to the next General Assembly.

III. *Administration*

7. The work of the Union shall be directed by the General Assembly of delegates appointed by the Adhering Bodies.

8. Voting at General Assemblies shall be by countries,

which shall have votes in accordance with the Group in which they adhere, as follows:

Group	I–III	IV–VI	VII, VIII
Number of votes	1	3	5

The Adhering Body of each country shall make known to the President before the opening of each General Assembly the names of the delegates (and of their substitutes) appointed to vote on behalf of that country. Each of the delegates present at a General Assembly shall have one vote only. Any Adhering Body not fully represented at a General Assembly may forward its remaining votes to the President by letter, and such votes shall be valid if received before the votes are counted.

9. The General Assembly may formulate By-Laws on any matters not covered by these Statutes.

IV. *Finance*

10. Each Adhering Body shall pay an annual subscription in accordance with the Group in which it adheres, as follows:

Group	I	II	III	IV
Number of unit contributions	1	2	3	5
Group	V	VI	VII	VIII
Number of unit contributions	7	9	12	15

11. The unit contribution shall be quoted in gold weight.

12. The financing and management of Special Projects of the Union may be kept distinct from General Expenditure, and Adhering Bodies shall be pledged only for the General Contribution.

13. The annual subscriptions shall be paid by the Adhering Bodies during the calendar year to which they apply.

14. Any Adhering Body which is in arrears with its contribution for two years shall be warned and shall be deprived of its voting power. Any Adhering Body which is in arrears for four years shall cease to be a member of the Union.

15. In the event of dissolution of the Union the General Assembly shall appoint a special Committee, reporting to the International Council of Scientific Unions, for the distribution of available assets of the Union to the Adhering Bodies in proportion to their contributions to the financing of the General Expenditure and Special Projects of the Union in the three years preceding dissolution.

V. *Statutes*

16. Changes in the Statutes may be proposed by the Executive Committee of the Union or by any of the Adhering Bodies. Notice of such proposed changes shall reach the General Secretary at least three months before a General Assembly. No change shall be made in the Statutes except at a General Assembly and with the approval of two-thirds of the votes of the Adhering Bodies.

VI. *Duration of the Union*

17. The duration of the Union is not limited.

18. The Union shall not be dissolved except at a General Assembly and with the approval of two-thirds of the votes of the Adhering Bodies.

VII. *Authoritative Text*

19. The present English text of the Statutes shall be considered the authoritative one.

BY-LAWS

I. *Administration*

1. The General Assembly shall normally meet every three years. If the date and place of the meeting have not been previously decided, they shall be determined by the Executive Committee and notice shall be despatched to Adhering Bodies at least six months in advance.

2. Commissions of the Union and Adhering Bodies may propose business to be transacted at General Assemblies. Such proposals shall reach the General Secretary at least fourteen weeks before the meeting.

3. The agenda of business to be transacted at General Assemblies shall be determined by the Executive Committee and shall be despatched to Adhering Bodies at least ten weeks before the meeting. No question which has not been placed on the agenda shall be discussed or put to the vote unless a proposal to that effect be approved by a majority of the votes of Adhering Bodies represented at the meeting.

4. The President may invite any scientist to an ordinary meeting of the General Assembly. Such invited guests may take part in the discussions but shall have no power of voting.

5. The General Assembly shall

- (a) give recognition to the National Committees;
- (b) elect the Officers of the Union;
- (c) elect Commissions of the Union and determine their terms of reference;
- (d) determine the Special Projects which shall be financed independently of General Expenditure;
- (e) receive reports on the activities of the Union and of its Commissions;
- (f) receive the budget and determine the unit contribution for General Expenditure and for Special Projects;
- (g) determine the general policy and the time-table for the period to the next General Assembly.

6. The Officers elected by the General Assembly are:

- (a) the President;
- (b) two Vice-Presidents;
- (c) the General Secretary;
- (d) the Editor of *Acta Crystallographica*;
- (e) three ordinary members.

These Officers are referred to as the Officers of the Union and constitute its Executive Committee. They hold office until the close of the ordinary General Assembly following that of their election. The President and Vice-Presidents are not eligible for re-election to the same office. Other Officers are immediately eligible for re-election.

7. The Executive Committee may fill by co-optation any vacancy occurring in its body. Any persons appointed shall hold office until the close of the next ordinary General Assembly.

8. Any officer unable to attend meetings of the Executive Committee may delegate his powers, including his vote, to a deputy duly nominated by him in writing.

9. The Executive Committee shall present an annual report to each Adhering Body and shall also report on its activities to the General Assembly. The report to the General Assembly shall be despatched by the General

Secretary to Adhering Bodies at least ten weeks before the meeting.

10. The President, on the advice of his fellow Officers, may call Extraordinary General Assemblies; he shall call such Assemblies at the request of not less than half of the Adhering Bodies.

11. The agenda of business to be transacted at Extraordinary General Assemblies shall be determined by the Executive Committee and shall be despatched to Adhering Bodies at least four months before the meeting. No question which has not been placed on the agenda shall be discussed or put to the vote unless a proposal to that effect be approved by a majority of the votes of Adhering Bodies represented at the meeting.

II. *President*

12. The President is Chairman of the General Assembly and of the Executive Committee. He is the legal representative of the Union and its supreme representative in dealing with other bodies. He is an ex-officio member of all Commissions and Committees of the Union.

13. The President, with the approval of the Executive Committee, may delegate specified parts of his powers and duties to other members of the Executive Committee.

III. *General Secretary*

14. The General Secretary is responsible for conducting the ordinary business of the Union and for keeping its records. He is an ex-officio member of all Commissions and Committees of the Union.

IV. *Commissions of the Union*

15. The Commissions of the Union established by the General Assembly may co-opt further members and shall generally have full freedom in arranging their internal structure and work. They may formulate their own Statutes and By-Laws within the framework of the Statutes and By-Laws of the Union. If special funds are provided for their use they may make their own financial arrangements, subject to the approval of the Executive Committee.

16. The Chairman, or in the case of Joint Commissions one representative, shall forward records of all meetings of the Commissions to the General Secretary and shall report on the activities of the Commissions to the General Assembly. The report to the General Assembly shall reach the General Secretary at least three months before the meeting and shall be despatched by him to Adhering Bodies at least ten weeks before the meeting.

V. *Finance*

17. The Executive Committee shall prepare an estimate of the budget for each of the years between the next General Assembly and that following it. These estimates shall reach the General Secretary at least three months before the meeting and shall be despatched by him to Adhering Bodies at least ten weeks before the meeting.

VI. *Authoritative Text*

18. The present English text of the By-Laws shall be considered the authoritative one.