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Preliminary study of the structure of a new synthetic hydrate of aluminum arsenate.*

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In an attempt to increase the size of synthetic crystals of aluminum orthoarsenate ($AlAsO_4$) as grown by the hydrothermal method, a change was made in the normally used temperature gradient and mixture concentration of Al_2O_3, As_2O_5 and H_2O. Instead of obtaining single crystals with the usual well developed α-quartz type of morphology, a dense polycrystalline product resulted. The aggregate was in the form of fibrous crystallites in parallel arrangement which readily parted into exceedingly fine, clear needles suitable for X-ray and optical studies. The material used in this study was grown by Mr J. M. Stanley of this laboratory.

Differential thermal analyses, loss-in-weight measurements, Debye–Scherrer powder studies, and chemical analysis all indicated the material to be a hitherto unreported synthetic hydrate of aluminum arsenate. The end product of thermal decomposition studies at 1000° C. was found to be aluminum orthoarsenate ($AlAsO_4$).

The following oxide formulation was determined by chemical analysis: $1Al_2O_3.3As_2O_5.10H_2O$.

Rotation photographs were taken of a single crystal using filtered Cu K radiation, the crystal being rotated about the fiber axis. Uniform optical extinction between crossed Nicols along the needle axis indicated this direction to be a crystallographic axis. An orthorhombic unit cell was established, using rotation and Weissenberg photographs, with dimensions

$$a = 12{\cdot}30,\ b = 4{\cdot}64,\ c = 8{\cdot}61\ \text{Å}.$$

The pycnometric density of a powdered sample was measured, using acetone, and found to be 3·19 g.cm.$^{-3}$. The calculated density for two molecules per unit cell was 3·27 g.cm.$^{-3}$.

Zero-, first- and second-level Weissenberg photographs were taken about the b or fiber axis, using the equi-inclination method for the latter two levels. All reflections for which $h+k+l$ are odd were absent. These extinctions indicate a body-centered unit cell; the possible space groups are: D_{2h}^{25}–$Immm$, C_{2v}^{20}–$Imm2$, D_2^8–$I222$.

A complete structure determination has been started.

* Presented at June 1953 meeting of American Crystallographic Association, Ann Arbor, Michigan, U.S.A.

Letters to the Editor

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The training of modern crystallographers.

From Kathleen Lonsdale, *Chemistry Department, University College, London W.C.1, England*

(*Received* 16 *September* 1953)

In his constructively critical review (*Acta Cryst.* (1953), **6**, 751) of A. Guinier's *X-ray Crystallographic Technology*, Dr Pepinsky takes courteous exception to the statement made in my foreword that 'it is still difficult for a thorough training in the subject to be obtained except in a few places, either in Great Britain or the U.S.A.'.

As this question of the training of modern crystallographers is one of first importance for the future of our science, I would like to discuss it further. It is perhaps significant that there is at present no opportunity for such discussion at the forthcoming International Congress in Paris except under the heading 'Miscellaneous'.

May I therefore throw out a challenge and say that in my opinion most crystallographers, including myself, are almost uneducated in their own field. Until this is remedied, I believe that our work will be pedestrian and our subject regarded simply as a highly specialized form of technology instead of as an important science with many technological applications. Confirmation of this is to be found in the fact that libraries and book publishers rarely have a separate category for 'Crystallography' (even though it is one of the few sciences to have a really active International Union) and our books are to be found nestling uncomfortably, like cuckoos or ugly ducklings, among 'Chemistry', 'Physics', 'Geology', 'Mathematics' or what-have-you.

P. Terpstra's *A Thousand and One Questions on Crystallographic Problems* (for junior students), reviewed in your columns by Dr N. F. M. Henry (*Acta Cryst.* (1953), **6**, 432), and in the *American Mineralogist*((1953), **38**, 421) by Drs J. D. & G. Donnay, quite justifiably provoked the comments that 'At present it is certain that a considerable proportion of the large number of students in X-ray crystallography have not received an adequate education in subjects such as projections, the geometry and symmetry of crystals, crystal twinning and calculations', and that 'anyone who could answer all these questions would be a well-rounded crystallographer indeed'. But these problems included *none* on diffraction theory, advanced structure analysis, crystal chemistry, crystal dynamics, crystal physics (except for practical crystal optics), crystal growth and equilibrium of the crystalline surface, the technology of X-ray, neutron or electron diffraction, the history of X-ray analysis and many other branches of modern crystallography which are included in the two-year courses of

lectures and practical work given, for example, in this University, for the degree of M. Sc. (Crystallography), by specialists in each field.

To be able to run an X-ray equipment, to measure and interpret X-ray photographs, to complete a structure analysis and write a paper on it is *not* a sufficient training for a modern crystallographer, any more than to be able to carry out a complicated chemical analysis is sufficient training for a chemist. Most of us know this, but have not faced the implications, because we prefer research to pedagogy. But this is not the way in which the best research is ultimately done. Perhaps it is a pity that we call our science 'Crystallography', when it is really the study of the solid state, with all that that implies.

I am clear that while trained chemists, biochemists, physicists, geologists, engineers or mathematicians may eventually make good crystallographers, the training of a really first-class crystallographer must include something of all these sciences and does, in fact, merit much more careful planning than it has hitherto had. Crystallography could be a first-degree subject in itself, with these other subjects as necessary or desirable ancillaries, and with *branches* of crystallography as subsequent fields for specialization.

Meanwhile I maintain that the places where even a partially adequate training in crystallography can be obtained are few indeed, not more perhaps than a dozen. I should be glad to be proved wrong.

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).

International Union of Crystallography

The Union has received the following most generous donations as contributions towards the expenses of its publications:

From the Netherlands Organization for Pure Research (Z.W.O.) the sum of fl. 15,000 (approximately £1,500) for *Structure Reports*.

From Messrs CIBA A. G. the sum of Swiss fr. 2,000 (approximately £165) for *Acta Crystallographica*.

Commission on Crystallographic Nomenclature

The Executive Committee has accepted the recommendation of the Commission that E. W. Nuffield (Canada) should be co-opted on to the Commission.

Conference on Defects in Crystalline Solids

The H. H. Wills Physical Laboratory of the University of Bristol, England, in co-operation with the International Union of Pure and Applied Physics (particularly its Commission on the Physics of the Solid State) and with The Institute of Physics, is organizing a conference on 'Defects in Crystalline Solids' from 13 to 17 July 1954 in Bristol. While not excluding other subjects in the field the organizers propose to give particular attention to defects such as dissolved atoms, vacancies and F-centres, to microwave resonance methods of investigating their properties, and to the way in which they re-act with dislocations. Thus dislocations will be discussed in their chemical aspects, as influencing diffusion and precipitation in the solid state, rather than in relation to plastic flow.

It is hoped that a number of authors from overseas will personally present their papers, and with this in mind the Conference has been arranged to follow immediately after the General Assembly of the International Union of Pure and Applied Physics.

Board and lodging will be provided in Wills Hall (a student hall of residence) on special terms, or at hotels.

The Conference is open to any scientist interested in this field, subject to the limitations of accommodation.

Further particulars may be obtained from the Secretary, H. H. Wills Physical Laboratory, Royal Fort, Bristol 8, England, or from the Secretary, The Institute of Physics, 47, Belgrave Square, London S.W. 1, England. Those wishing to attend the Conference are asked to apply to the former, marking the envelope '1954 Conference' and stating whether they wish to be accommodated at Wills Hall or at an hotel and for what nights accommodation is required.

Photoelasticity and Photoplasticity

The International Union of Theoretical and Applied Mechanics announces that a Colloquium on the above subject will be held in Brussels, Belgium, from 29 to 31 July 1954. The Union also announces that a Colloquium on the Solid State will be held in Madrid, Spain, during 1955.

Crystallographers interested are invited to attend these meetings; further information may be obtained from the Secretary of the Union (F. H. van den Dungen, 48 avenue de l'Arbalète, Boitsfort, Brussels, Belgium).