SCIENTIFIC BOOKS

X-RAY CRYSTALLOGRAPHY

X-Ray Crystallography. An Introduction to the Investigation of Crystals by their Diffraction of Monochromatic X-Radiation. By M. J. BUERGER, associate professor of mineralogy and crystallography, Massachusetts Institute of Technology. xxii + 531 pp. New York: John Wiley and Sons, 1942. $6.50.

THIS useful book deals with that part of x-ray structural analysis employed to determine for a crystalline substance "the crystal symmetry in the larger sense: the crystal class, the space lattice (its type and dimensions), and the space-group." The material covered is further limited to those techniques which utilize single crystals and monochromatic radiation, thus excluding consideration of the powder and Laue procedures; in point of fact the discussion of the rotating and oscillating crystal techniques, while quite adequate, is incidental to the treatment of the various moving film methods. Although requiring somewhat more complicated equipment, the moving film methods offer the great advantage of registering three film coordinates for each diffraction spot. The author shows how to exploit this and other advantages fully and with great simplicity, particularly for the most important "equi-inclination" Weissenberg method.

Essential theory, design and operation of apparatus, simple indexing procedures, connections with group theory, precision determination of lattice constants—these and related topics are treated in great detail. A discussion of the systematic application of plane-group theory to the interpretation of the observed diffraction symmetries of equi-inclination Weissenberg photographs resulting in a very direct determination of the probable space-group(s) rounds out a definitive treatment of the Weissenberg method. The limitations of any x-ray method for determining the space group of a crystal are properly emphasized, and detailed tables makes clear the specific ambiguities wherever they arise. The inclusion of a brief discussion of auxiliary methods, *e.g.*, observation of face development, tests for piezo and pyro electricity, etc., which frequently aid in the selection of the probable space-group, would have provided additional guidance in this connection.

The book is addressed primarily to those more or less actively engaged in some phase of crystal structure analysis and should be particularly useful to the beginner in the field. Only a quite modest background in physics and mathematics is required, the development is extremely detailed, and the text is replete with excellent diagrams and illustrations. In the opinion of this reviewer and of two of his students who have used the book extensively, the treatment would have gained ultimately in clarity while permitting of some condensation through the more consistent use of elementary vector analysis. A separate section or appendix, giving in one place a complete explanation of the systematic notation now used for space-groups also would have been desirable.

The comprehensive account given of the Weissenberg equi-inclination method should encourage the wider use of this powerful technique. An equally detailed companion volume to continue with the more interesting and more difficult problem of determining atomic positions within the unit of structure would be welcomed, especially by the student beginning the study of structural analysis.

J. L. HOARD

CORNELL UNIVERSITY

EXPLOSIVE CHEMISTRY

Laboratory Manual of Explosive Chemistry. By ALLEN L. OLSEN and JOHN W. GREENE. vi + 106 pages. 13.8 × 21.1 cms. New York: John Wiley and Sons, Inc. London: Chapman and Hall, Limited. 1943. Price $1.75.

THE material in this manual has been used by the authors in presenting short courses in explosives under the Engineering Science and Management War Training Program. The book is primarily a compilation of the usual chemical analyses and specifications of the common military explosives. As the authors have stated, the details of testing and the included specifications are those which have been outlined by the War Department in their most recent printing of "Military Explosives, Technical Manual, TM 9–2900." Olsen and Greene have, however, included more detail and have emphasized precautions in manipulations.

The contents have been divided into five chapters: I. Safety. II. Propellants, Raw Materials. III. Propellants, Nitrocellulose and Smokeless Powder. IV. High Explosives. V. Primers, Igniters and Initiators. Following the last chapter is an appendix on "Sampling."

The chapter on "Safety" is valuable but does not place sufficient emphasis on the individual characteristics of explosives and the frequent unpredictability of their behavior. It should be demonstrated to the student that there are three types or classes of explosives and that there is a wide range of behavior in each class. These facts can be made clear by a few simple experiments with such explosives as black powder, smokeless powder, lead azide, nitroglycerin and guncotton.

The text is very limited, for it has nothing to offer the chemist or physicist who is engaged in research on explosives or to any one who is interested in testing the explosive properties of these substances. Although the authors obviously did not have such read-

ers in mind, this expectation would not arise if the title were a less comprehensive one, such as "Chemical Analysis and Specifications of Military Explosives."

The text will be a handy reference for persons engaged in control analysis since the directions are clear and concise. It is, perhaps, a small point, but the reviewer hopes that the phrase "explosive chemistry" occurring in the title of the text does not find common usage. Many students and chemists have had experiences in "explosive chemistry" without having been interested at such times in the "Chemistry of Explosives."

JOSEPH ACKERMAN, JR.

NORWELL, MASS.

SPECIAL ARTICLES

GUAYULE PLANTS WITH LOW CHROMOSOME NUMBERS

SUCH Russian workers as Dianova *et al.*[1] and Botschanszeva[2] reported that *Parthenium argentatum* (guayule) usually has 72 chromosomes (diploid number). Recently we learned from G. Ledyard Stebbins, Jr. (personal communication), that he has found among plants from commercial strains from Salinas the following chromosome numbers: $2n = 54$, 58 (± 2), 72, 74 and 108–112.

In the fall of 1942, Dr. LeRoy Powers collected seeds of guayule in Mexico and Powers and Walter T. Federer in the Trans-Pecos region of Texas. Many of the plants grown from seeds collected in Durango, Mexico, have thinner leaves than those of the 72-chromosome types. In general they may be characterized as vigorous growers, early and prolific seed producers. Many are light green in color, probably due to a chlorophyll deficiency. On both light and dark green plants the trichomes are shorter than on plants of higher chromosome number. Eleven of these plants were examined cytologically and were found to have from 36 to 39 chromosomes. They are from four different locations within the mountainous area on the border of which are the towns of Santa Librada, Patinta, Maravillas, Capilla and S. Francisco, southwest of the city of Mapimí.

Chromosome counts were made mostly at the diakinesis and prophase II stages in pollen-mother-cells because chromosomes are better separated then than at metaphase II, although the latter was used whenever possible. Flower heads were prefixed in a mixture of seven parts absolute alcohol and one part glacial acetic acid. Dissected disc florets were stained with synthetic orcein in 45 per cent. acetic acid. Mature pollen grains were stained with aniline blue-lactophenol. Five hundred from each plant were counted to determine the amount of aborted grains. The diameter inside the exine of 100 grains from each plant was measured with an ocular micrometer.

These plants are considered to be diploids because at diakinesis all eleven plants have 18 pairs of chromosomes. A few pollen-mother-cells in one plant seemed to show an association of four chromosomes and in another plant possibly as many as three such associations. Whether these are due to reciprocal translocations or are an indication of polyploidy is not known at present. In addition, most of these plants showed one, two or three very small chromosomes. These very small chromosomes are to be seen also in plants from Texas and in commercial strains. A study of somatic chromosomes seen occasionally in dividing tapetal cell nuclei has led to the supposition that these small chromosomes are the equivalent of the short arm of one of the types of medium-sized chromosomes. Lagging chromosomes were seen in one plant. Chromatid bridges were observed in three other plants.

In addition to these eleven plants, the pollen of another from the same area was studied carefully. Although the amount of aborted pollen varied considerably among the different plants (from 3 per cent. to 60 per cent.) the diameter inside the exine of filled grains was quite uniform. An average of these twelve plants showed that 5 per cent. measured 12.4 μ, 33 per cent. 14 μ, 58 per cent. 15.5 μ and 3 per cent. 17.1 μ. The grains are not absolutely spherical. For comparison, an average of five plants which belong to the 72-chromosome class showed that one per cent. measured 15.5 μ, 9 per cent. 17.1 μ, 57 per cent. 18.6 μ, 27 per cent. 20.2 μ, 5 per cent. 21.7 μ, and one per cent. consisted of giant grains. In addition, a limited examination was made of the pollen of 28 more plants from the same area. Since all showed the same-sized pollen grains as the 12 mentioned above, they also are considered to be diploids having 36 or about 36 chromosomes.

A cytological study also has been made of two dwarf plants from seeds collected in Texas. Both were found recently by Dr. Powers among plants grown from seed collected on the O2 Ranch. They are dwarfed, with thin, crinkled leaves that have a tendency to cup. One had a height of 5 cm and spread of 6 cm compared with nine normal plants in the same collection and culture which averaged 14 cm and 14 cm respectively. The second had a height of 7 cm and spread of 7 cm, while eight normals in the same collection and culture averaged 13 cm and 15 cm, respectively. How-

[1] V. I. Dianova, A. A. Sosnovetz and N. A. Steschina, *Beih. Bot. Centralb.*, 53: 294, 1935.

[2] S. Botschanszeva, *Acta Univ. Asiae Mediae, Tashkent, Ser. VIII b, Botanica:* fasc. 15, 1933.