SCIENTIFIC APPARATUS AND LABORATORY METHODS

A SAFETY RAZOR BLADE WHICH CUTS AS WELL AS THE BEST MICROTOME KNIVES

Laboratory instruction in histologic and cytologic technique very often taxes the patience of the teacher when students abuse apparatus, especially the microtome knives. If a limited number of knives are used, students become careless and knives are soon dulled or nicked. Better results are obtained by assigning one knife to a small group. A still more satisfactory procedure is to let each student have one knife and burden him with the responsibility of keeping it in good condition. This, however, has the disadvantage that a great number of knives must be on hand, and that they have to be resharpened at the end of the course.

Recently, a new safety razor blade made its appearance, which is radically different from older types. It is curved and heavier than the ordinary blade. The curvature adds to its inherent strength, so that it is practically impossible to bend it. I tried this blade by attaching it to a piece of hard wood and was able to cut sections of four microns of Drosophila eggs without having the slightest variation in thickness. I communicated with the company which manufactures these blades, asking for the production of a holder, so as to be able to use the blades for general microtome work. After several conferences with the technical expert, I obtained a steel holder with the blade attached in the center. This curved safety razor blade with its holder gave me as good results as any knife I ever used. The blade is rigid, giving uniform sections of any thickness. It stands up under its own strength, being attached to the holder by only two screws. It is concave, approximating the best microtome knives on the market.

I requested the company to submit this product to all of us who for so many years have been looking for salvation from the troubles of microtome knives. I have been told that the holder will soon be advertised and introduced to the readers of Science.

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ANOTHER PETROGRAPHIC METHOD

There appeared in Science for April 5 a note by Charles Milton on microscope technique of especial interest to petrographers. It dealt with the use of the analyzer frame in determining refractive indices of powdered minerals under the microscope. That note suggests another. The Leitz Company has added to its standard petrographic microscope a special substage shader, the purpose of which is to give better results in determining refractive indices by the inclined illumination method. There are many who prefer the inclined illumination method to any other though it may not be any more accurate or convenient. The shader consists of a small plate on a swinging arm controlled by a convenient lever. It swings in below the condensing lens and above the polarizer. The intensity of the illuminated or darkened margins of grains is very satisfactory indeed both with white and diffused monochromatic light and a high degree of accuracy is afforded. It is of course much more convenient than the use of the finger or a card. The shader has been developed by W. Zieler, of the Leitz Company in New York City. It is announced by the writer at the request of Mr. Zieler.

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SPECIAL ARTICLES

A METHOD OF DETERMINING THE AXIAL RATIO OF A CRYSTAL FROM X-RAY DIFFRACTION DATA: THE AXIAL RATIO AND LATTICE CONSTANTS OF ZINC OXIDE

An X-ray diffraction pattern taken by the powder method gives directly the interplanar spacings of the most important planes. In the case of a hexagonal or tetragonal crystal most of these spacings are dependent on both "a" and "c," which are the lattice parameters along the X (or Y) and Z axes respectively. Only a few of these spacings are dependent on either "a" or "c" alone. An accurate determination of the axial ratio could not be made by direct calculation from these few spacings.

A graphical method of finding the axial ratio from a group of interplanar spacings has been developed by Hull and Davey.[1] It is evident to any one who has used this method that it is only approximate. Since the values of "a" and "c" can not be calculated without knowing the axial ratio, it is necessary, for any accurate measurement of the lattice parameters of a crystal, to know the axial ratio accurately.

A very accurate method of finding the most probably correct value of "a" for cubic crystals, from a series of observed interplanar spacings, has been described by Davey.[2] The method consists of plotting on arithmetic probability paper[3] the values of "a," calculated from the observed interplanar spacings,

[1] A. W. Hull and W. P. Davey, *Phys. Rev.*, 17: 549, 1921.

[2] W. P. Davey, *General Electric Review*, 29: 118–128, 1926.

[3] A. Hazen, *Trans. Am. Soc. C. E.*, 77: 1539, 1914.

against the per cent. of the values that are equal to or smaller than their respective values. Since the calculations are ordinarily made by means of logarithms it has been found to be a convenience in actual practice to plot the logarithms of "a" instead of the actual values calculated for "a" from each of the interplanar spacings. Davey found that the degree of reproducibility of measurements on an X-ray pattern was such that when eight or more values were considered the probability curve was a straight line between the 30 and 70 per cent. points. The value of log "a" at the 50 per cent. point is taken as the most probably correct value.

At the suggestion of Dr. Davey this method was adapted to finding the axial ratio of a hexagonal crystal. The axial ratio is found approximately from the charts of Hull and Davey.[1] A group of seven or eight values approximating this axial ratio is selected and, for each of these axial ratios, values of log "a" are calculated from each of the observed interplanar spacings.

The values of log "a" for each axial ratio are plotted on probability paper according to the method of Davey, one curve for each axial ratio. That curve based on the most probably correct axial ratio will be closest to being a straight line. All others either side of it will be progressively farther from being a straight line because that curve whose points are calculated in terms of the true axial ratio will be the nearest approach to a true probability curve. On this type of plotting paper this is a straight line. The value of log "a" can be read directly from the 50 per cent. point of the curve based on the true axial ratio.

The sensitiveness of the method is illustrated below in the case of zinc oxide. The zinc oxide used was made by H. M. Cyr and L. M. Andreuzzi, of this laboratory, by burning spectroscopically pure zinc in air. C. C. Nitchie, also of this laboratory, tested the specimen on the quartz spectrograph and found it to contain only very faint traces of impurities. The General Electric X-ray diffraction apparatus was used in making the X-ray patterns.

TABLE I

Planes	Spacings
10.2	1.908
11.0	1.622
10.3	1.474
11.2	1.376
20.1	1.352
20.3	1.090
12.1	1.038
10.5	0.974
12.3	0.904

Table I gives the average observed interplanar spacings, taken from three films, which were used in the final calculations.

The Hull and Davey charts give an axial ratio of 1.61 from these data, hence a series of axial ratios from 1.606 to 1.613 was selected for the calculations. The curves plotted from these data are shown in Fig. 1. The origin of coordinates is shifted for each curve

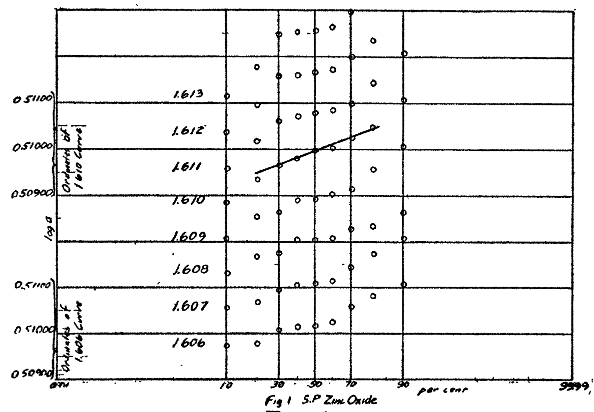

FIG. 1

in order to avoid overlapping of the curves. The ordinates for two of the curves are indicated on the figure. There is no doubt that the points of the 1.610 curve come closest to being in a straight line. The value of log "a" at the 50 per cent. point of this straight line will give the most probably correct value of "a."

The unit cell dimensions of zinc oxide of extremely high purity are, therefore, $a = 3.235 \pm .003$ A $c = 5.209 \pm .005$ A $c/a = 1.610 \pm .001$. This value of the axial ratio is slightly higher than the value 1.608 accepted by Bragg[4] and by Weber[5] and considerably higher than the value 1.596 obtained by Barth.[6]

The sensitiveness of the method seems to depend upon the number of values of log "a" plotted on each

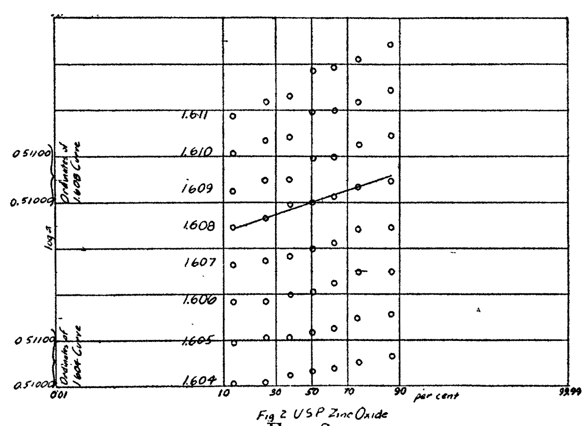

FIG. 2

[4] W. L. Bragg, *Phil. Mag.*, 39: 647, 1920.
[5] L. Weber, *Zeit. f. Krist.*, 57: 398–403, 1922.
[6] Tom Barth, *Norsk Geol. Tids*, 9: 317–319, 1927.

curve. This may be illustrated by the data of Figs. 2 and 3. Fig. 2 shows curves plotted from seven observed values of interplanar spacings of U.S.P. zinc oxide (a grade of zinc oxide less pure than that made from spectroscopically pure zinc). Fig. 3 shows curves plotted from thirteen interplanar spacings observed on a sample of wurtzite (hexagonal zinc sulphide). The correct value of axial ratio for the U.S.P. zinc oxide is probably 1.608 ± .002 and for the wurtzite 1.636 ± .001.

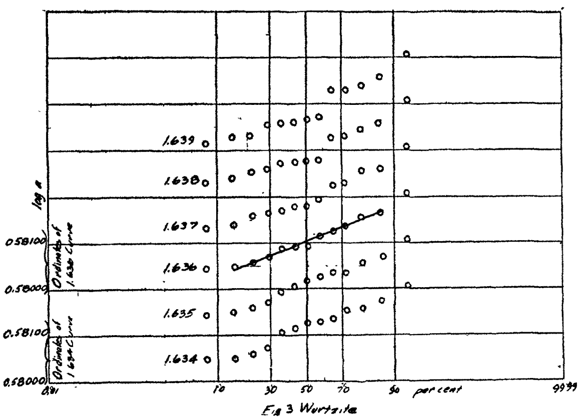

FIG. 3

The experimental work on U. S. P. zinc oxide was done by P. van Dyck, formerly of this laboratory. The complete data on wurtzite will be published elsewhere.

The author wishes to express his appreciation to those members of this laboratory, mentioned above, who cooperated with him in the work on zinc oxide, and to Dr. Wheeler P. Davey, of the Pennsylvania State College, who originally suggested this method of determining axial ratio.

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THE NORTH CAROLINA ACADEMY OF SCIENCE

The twenty-eighth annual meeting of the North Carolina Academy of Science was held at the North Carolina College for Women, Greensboro, N. C., on May 10 and 11, 1929. Papers were presented before the general section of the academy on Friday morning and afternoon. Friday evening the retiring president, State Forester J. S. Holmes, gave his presidential address on "A State Forest Policy for North Carolina." This was followed by a talk from Dr. E. W. Gudger, of the American Museum of Natural History, a past president of the academy and the secretary-treasurer of the academy from 1908 to 1918. Dr. Gudger was given quite an ovation by the academy and his presence added much to the enjoyment of the meeting. Saturday morning the academy met in the following sections: general section, chemical section, mathematics section and physics section. Seventy-four papers and five exhibits were on the program. (Abstracts of most of these and complete papers of several will appear in an early number of the *Journal of the Elisha Mitchell Scientific Society.*)

The executive committee reported the election of forty-two new members during the year and the reinstatement of six former members. Two hundred and seventeen registered at the meeting.

Miss Lila Aaron, a student of the Lexington high school, was declared the winner of the high-school science prize, a silver loving-cup, for the best essay submitted by a high-school student. (Essays for 1929 were confined to the fields of biology, geology and geography.)

The officers elected for the year 1929–30 were:

General Academy

President, J. B. Derieux, State College.
Vice-president, J. B. Bullitt, University of North Carolina.
Secretary-treasurer, H. R. Totten, University of North Carolina.
Executive committee, the above officers and W. C. George, University of North Carolina; F. A. Wolf, Duke University, and Bert Cunningham, Duke University.
Representative to the A. A. A. S., W. C. Coker, University of North Carolina.

Chemical Section

Chairman, Frank K. Cameron, University of North Carolina.
Vice-chairman, O. J. Thies, Jr., Davidson College.
Secretary-treasurer, L. B. Rhodes, North Carolina Department of Agriculture.
Councilor, F. W. Sherwood, State Experiment Station.

Mathematics Section

Chairman, Helen Barton, North Carolina College for Women.
Secretary, W. W. Elliott, Duke University.

Physics Section

Chairman, Otto Stuhlman, Jr., University of North Carolina.
Secretary, G. B. Collins, Duke University.

The twenty-ninth annual meeting of the North Carolina Academy of Science will be held at Duke University, Durham, N. C., in the spring of 1930.

H. R. Totten,
Secretary