A GRAPHICAL SIMPLIFICATION OF THE RELATIONSHIP BETWEEN 2V AND Nx, Ny AND Nz

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This diagram like those of F. E. Wright (3) and H. T. U. Smith (2) yields the value of 2V if the three refractive indices of a biaxial crystal are known, or yields the value of the third refractive index if 2V and the other two indices are known. The advantage offered: that the sign of the crystal is automatically indicated and no sliding scales are needed. It is the graphic solution of the same equation,

$$\text{Tan}^2 V = \frac{Nz - Ny}{Ny - Nx}$$

in simplified form.

The use of the diagram is expressed in the key inserts. Abscissa and ordinate scales are the partial birefringences, the ordinate being the larger and the abscissa the smaller of the two. Nz−Ny is found on the right side and Ny−Nx on the left of the diagram, the larger as the ordinate. The radial through the point of intersection gives 2V and the side of the diagram on which the point of intersection falls gives the sign.

Two examples will illustrate:

(1)	Nx=1.596	2V is unknown
	Ny=1.600	Ny−Nx=.004
	Nz=1.612	Nz−Ny=.012

.012, the larger of the partial birefringence values, is found on the right hand ordinate scale—the right hand since it is Nz−Ny and the ordinate since it is the larger. .004, the smaller value is found on the left hand abscissa scale. The radial through the point of intersection indicates a 2V of 60° and the sign is positive.

(2)	Nx=1.582	Nz is unknown
	Ny=1.590	Ny−Nx=.008
	2V=70° (−)	

As in the above case the larger value is again applied to the ordinate scale. Hence, it must be reasoned out as follows: generally, Ny is above the midpoint between Nz and Nx in a negative mineral and below in a positive mineral. Therefore, in a negative mineral Ny−Nx is the larger and Nz−Ny the smaller partial birefringences. In this case then, .008 is the ordinate. This intersects the 2V radial at the abscissa value .004 which is Nz−Ny. Hence, Nz=1.594.

In laboratories which take advantage of the dispersion of the Becke line, by using immersion media of high rather than low dispersion (1), a special advantage accrues. Such laboratories ordinarily use the Hart-

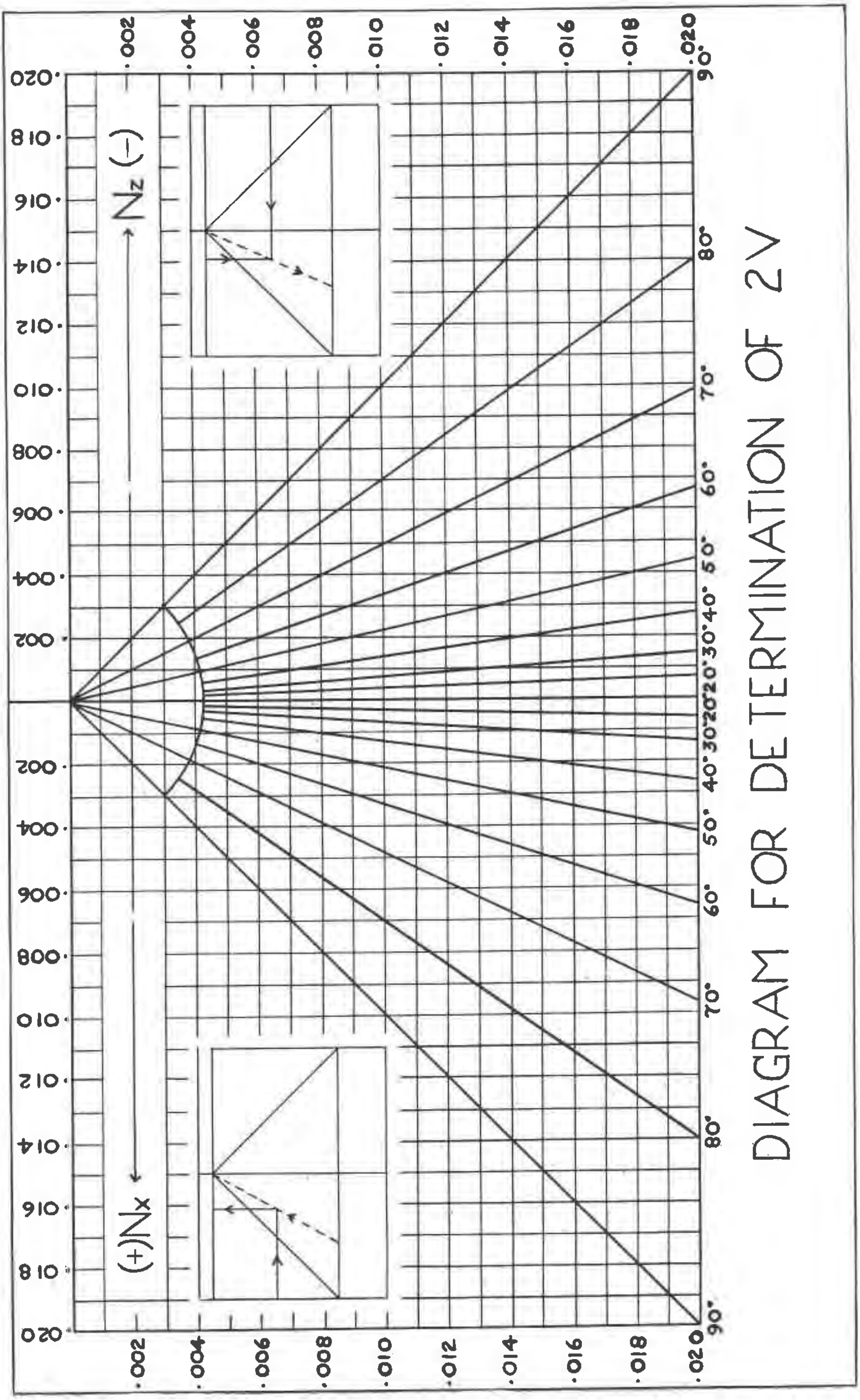
DIAGRAM FOR DETERMINATION OF 2V
Nz (−)
(+)Nx
.002
.004
.006
.008
.010
.012
.014
.016
.018
.020
20°
30°
40°
50°
60°
70°
80°
90°

mann net for the speed and accuracy it affords. For this use the coordinate scale divisions should agree with those of the net. Then, the D line of the net is made to coincide with these scales, the Ny value being 0. Nz−Ny and Ny−Nx are used directly without subtraction. For minerals of high birefringence the scale divions may be multiplied.

The diagram is constructed as follows: use the approximate formula

$$\text{Tan V} = \frac{\text{Nz} - \text{Ny}}{\text{Ny} - \text{Nx}}.$$

Allow Nz−Ny to equal unity and vary the value of V from 0° to 45°; obtain values for Ny−Nx ranging from 0 to 1 and varying in a function of Tan^2. If the value of Nz−Nx is then increased in arithmetic progression, corresponding values of Ny−Nx can be obtained for any value of V.

References

1. Emmons, R. C., and Gates, R. M., *Am. Mineral.*, **33**, 612–618 (1948).
2. Smith, H. T. U., *Am. Mineral.*, **22**, 675–681 (1937).
3. Wright, F. E., *Carnegie Inst. Publ.* **158**, Washington, 142–200 (1911).

AN IMPROVED "DIAMOND" MORTAR

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While the conventional "Diamond" mortar is efficient for grinding or crushing, it is almost impossible to clean it effectively so that no particle of the material ground is left to contaminate the next grinding.

The writer designed, and first made about ten years ago, an improved mortar which is cleaned very easily. Instead of a hole in the mortar it has a projection and the grinding hole is obtained by a close fitting sleeve around the projection. The pestle is a close working fit in the upper part of the sleeve as in the conventional mortar. After grinding, the sleeve is removed and the ground up material is shaken or brushed from the top. The face of the projection, which does the grinding, is cleaned very easily, but if any material adheres to the face it may be rubbed lightly over a sheet of fine sand paper. The face of the pestle is cleaned in the same manner.

The mortar proper is made from $1\frac{3}{4}$ inch round machine steel turned to the dimensions shown in the drawing. The sleeve is $1\frac{1}{8}$ inch by 10 gauge Shelby tubing, the inside bored, or drilled and reamed, to exactly $\frac{3}{4}$ inch, and both inside edges slightly chamfered so as to allow it to fit down tight on the mortar. The pestle is made from a piece of $\frac{3}{4}$ inch round machine steel, turned as shown in the drawing. The top part may be knurled or left plain as desired.