THE PREPARATION OF ORIENTED POLISHED SECTIONS OF SMALL SINGLE CRYSTALS

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Polished sections are ordinarily made of mineral aggregates. The orientation of a crystal under observation cannot be easily or accurately determined in such sections. In many instances information of great value could be obtained if polished sections of known orientation could be prepared. In a recent investigation[1] it was found necessary to prepare polished sections of tiny arsenopyrite crystals (from one to a few millimeters in diameter) in such a way that the plane of the section might have any predetermined orientation. For this purpose a simple instrument and technique were developed which gave excellent results. Undoubtedly many crystallographic problems may be solved by the use of oriented polished sections, so the technique of preparing them is herewith described.

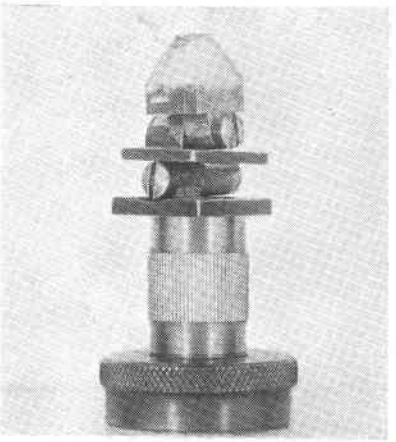


Fig. 1. Adjusting crystal holder. $\times\frac{2}{3}$.

The crystal is cemented to a holder (Fig. 1), which may be fitted to a goniometer for the purpose of orienting the crystal. After appropriate adjustment the holder is removed to a small grinding and polishing device (Fig. 2) where the actual section is prepared.

The crystal is mounted on the adjusting head with the aid of a cement

[1] Buerger, M. J., The symmetry and crystal structure of the minerals of the arsenopyrite group: *Zeit. Krist.* (A), in press.

known as *Coecal*, made by the Coe Laboratories of Chicago. Enough of the crystal should be permitted to project above the cement to allow appropriate orienting surfaces to give reflections when the head is in position on the goniometer.

The crystal adjusting holder is similar to the customary goniometer adjusting crystal holders except that, for the sake of ruggedness, convenience is sacrificed for simplicity. There are no translation sledges, and the two orthogonal rocker arcs are replaced by hinges. These are freed for adjustment by loosening the screws, and locked by tightening them. The entire adjustment head fits on a standard fitting on the

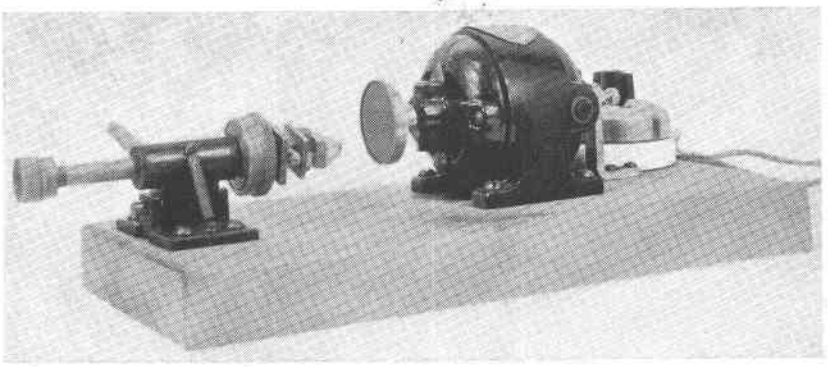


FIG. 2. Apparatus for grinding and polishing oriented sections of small crystals. $\times\frac{1}{3}$.

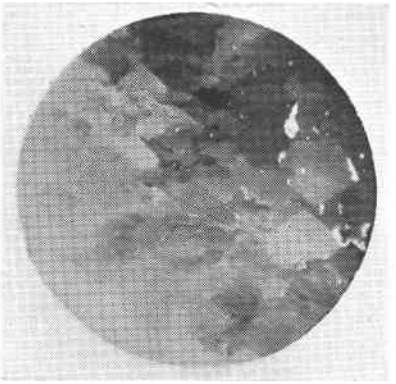
goniometer spindle which accomodates removable adjusting devices of all sorts (for example, adjusting heads for x-ray apparatus[2]). The crystal adjusting head fits by the same means to the feed arm of the grinding device. To promote rigidity in this position, the length of the head is reduced by the removal of a central pillar.

The grinding is done by holding the crystal against a rotating lap. The motive power is furnished by a small 1/150 H.P. Westinghouse motor operated directly from the standard power supply, but with the speed reduced and appropriately adjusted by means of a rheostat. During the grinding and polishing operation the crystal is held against the lap by means of the feed knob seen at the extreme left of Fig. 2. This places the crystal in an eccentric position on the lap, the degree of eccentricity being varied during the operation by depressing the lever (seen above the left center of the feeding device) against a spring.

[2] Buerger, M. J., An apparatus for conveniently taking equi-inclination Weissenberg photographs: *Zeit. Krist.* (A) vol. **94**, pp. 91–92, 1936.

We have obtained good results by the following procedure: For small crystals a few millimeters long, the grinding is done entirely with #000 emery paper as the abrasive. For larger crystals #1 is used first, followed by #000. These abrasive papers are held to the disk by means of a tight fitting ring. The rotation speed should be fairly high for large crystals but low for small ones.

After the correct surface is exposed by grinding, the abrasive paper is removed and a fine or medium grade of linen substituted for subsequent polishing. The polishing abrasive is chrome oxide, which is rubbed on the linen dry. The rotation speed for polishing should be relatively high. In



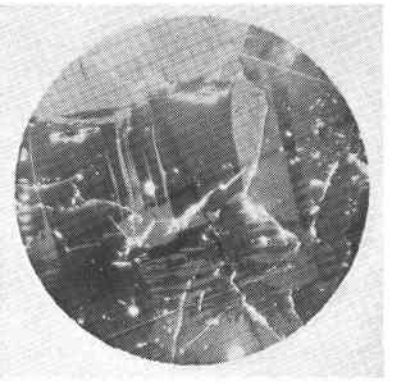


FIG. 3. Polished surface of small Joplin marcasite crystal, showing lineage structure. Surface approximately parallel with (010) (new orientation). Crossed nicols. ×55.

FIG. 4. Polished surface of small Sulitjelma danaite crystal showing polysynthetic twinning. Surface approximately parallel with (010) (new orientation). Crossed nicols. ×55.

order to eliminate polishing streaks on the surface, the crystal is moved back and forth across the lap by operating the eccentricity lever of the feed.

Figs. 3 and 4 show examples of the polished sections obtained by the procedure outlined and photographed between crossed nicols to bring out the structures under investigation.

We are greatly indebted to Mr. O. von der Heyde for constructing the apparatus from rough sketches and for improving our original design.