CRYSTALLOGRAPHY OF LITHIUM MOLYBDO-TELLURATE

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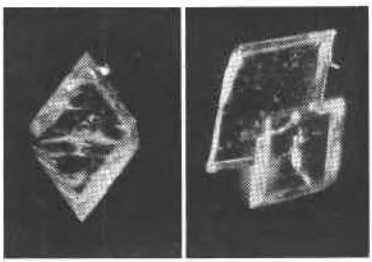
GENERAL

Lithium molybdo-tellurate is a new compound prepared by S. R. Wood, who gave it the following chemical formula: $3\ Li_2O \cdot TeO_3 \cdot 6MoO_3 \cdot 13\ H_2O$. He carried on the study of this salt at the University of Wisconsin, under the direction of Professor V. M. Meloche; his results are to be published in the *Journal of the American Chemical Society*. We wish to thank Professor Wood for sending us the necessary material and also the photographs accompanying this paper.

The specific gravity of lithium molybdo-tellurate is 2.2 ± 0.1. Its hardness is $2\frac{1}{2}$. The substance separates from its water solution in clear transparent crystals, which are colorless or very pale pink and measure from one to five millimeters in the longest dimension.



Photographs of crystals of lithium molybdo-tellurate.
(Photo by S. R. Wood.)

FORM

Lithium molybdo-tellurate crystallizes in the rhombohedral subsystem of the hexagonal system. The only common form observed is the unit form,[1] an acute rhombohedron p $\{100\}$ $\{10\bar{1}1\}$ the lateral edges of which are, on one crystal only, truncated by a very narrow 2nd order hexagonal prism d^1 $\{10\bar{1}\}$ $\{11\bar{2}0\}$; the latter form shown by one "line face" only. With no other form present, the crystal class cannot be determined from the morphology.

No distinct cleavage could be produced although some of the photographs seem to indicate a basal cleavage $a^1\{111\}$ $\{0001\}$.

The crystals often show a thick tabular habit due to a flattening on one of the rhombohedral faces; this malformation is characteristic (see photos).

[1] The Lévy form-notation is used in conjunction with the Miller and Bravais indices.

The axial elements are as follows: Plane angle of the polar edges (interaxial angle in the Miller system of coordinates): $\alpha = 71°2'$. Axial ratio (in the hexagonal system of reference): $c:a = 1.9150$. Barker classification angle: 65°40′.

Measurements

Seven crystals were measured by means of the non-modified type of the Wollaston goniometer. Thirty-one readings were obtained for the angle between the rhombohedral faces; they range from 103°35′ to 104°44′. The most probable value is 104°12′, with a probable error of 3′.

Table of Measured and Computed Angles

Angle			Number of readings	Measured	Computed
Lévy	Miller	Miller-Bravais			
pp	(100:010)	$(10\bar{1}1:\bar{1}101)$	31	*104°12′	—
pd^1	$(100:10\bar{1})$	$(10\bar{1}1:11\bar{2}0)$	1	38°49′	37°54′

The large discrepancy between the measured and the calculated angle pd^1 is accounted for by the poor reflection obtained from the face d^1 ("line face").

Morphological Lattice

It is well known that, in a rhombohedral lattice, the unit rhombohedron p $\{100\}$ $\{10\bar{1}1\}$ has the highest reticular density of all net planes provided the quantity $\frac{3}{2}\frac{a^2}{c^2}$, usually denoted by λ, is larger than 0.25 and smaller than 4 (where $c:a$ is the axial ratio in the hexagonal system of coordinates). When the value of λ falls below 0.25, the base a^1 $\{111\}$ $\{0001\}$ becomes denser than p $\{100\}$ $\{10\bar{1}1\}$; when λ exceeds 4, the deuteroprism d^1 $\{10\bar{1}\}$ $\{11\bar{2}0\}$ dominates over p $\{100\}$ $\{10\bar{1}1\}$.

In the case of lithium molybdo-tellurate, $\lambda = 0.409$. According to the Law of Bravais, the dominant form should be the unit rhombohedron. It is.

In the hypothesis of a hexagonal space lattice, the λ value obtained for lithium molybdo-tellurate leads to the following sequence of planes, listed according to decreasing reticular densities:

$p\{0001\}$, $m\{10\bar{1}0\}$, $b^1\{10\bar{1}1\}$, $b^2\{10\bar{1}2\}$, $b^3\{10\bar{1}3\}$, $h^1\{11\bar{2}0\}$, $a^1\{11\bar{2}1\}$, $a^2\{11\bar{2}2\}$, · · ·.

The predominance of the base and the protoprism in this list show how ill-fitted to describe the crystals the hexagonal lattice (and 4-index Bravais notation) would be.

Since the unit rhombohedron is practically the only form observed, there can be no doubt about the determination of the Haüy-Bravais lattice as rhombohedral. The 3-index Miller notation is therefore the more appropriate.

Optical Properties

The crystals are uniaxial negative. The refractive indices, for Na light, are: $n_\epsilon = 1.612$, $n_\omega = 1.703$; both ± 0.001. These values have been obtained by the immersion method, each liquid being checked on the refractometer.

Maximum birefringence: $n_\omega - n_\epsilon = 0.091$ (calculated).

The section birefringence on $p\{100\}$ $\{10\bar{1}1\}$ is 0.080 (measured); the retardation was measured with a Berek compensator and the thickness by means of the focussing screw of the microscope. The same birefringence, calculated from the indices, is 0.076. The two values agree within 5 *per cent.*, which is satisfactory.

Recrystallization on a Glass Slip

A drop of aqueous solution of the substance recrystallizes on a glass slip, yielding tiny rhombic tablets $p\{100\}$ $\{10\bar{1}1\}$ with a plane angle of *ca.* 70°. These crystals are suitable for optical examination. The section birefringence on p was determined by means of such recrystallized tablets.