

On the crystalline form of nitrogen sulphide.

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IN the course of an investigation¹ of the atomic weight of nitrogen Mr. F. P. Burt, of University College, London, prepared by the following process crystals of nitrogen sulphide, N_4S_4 , surpassing in purity any that had been previously obtained. The nitrogen sulphide was re-crystallized from benzene, washed with carbon disulphide to remove as much sulphur as possible, and finally washed with a little cold benzene. The product was powdered on a porous tile, and kept in a desiccator with calcium chloride and cocoa-nut charcoal until it no longer smelt of benzene. It was then sublimed *in vacuo* over silver gauze heated to $100^\circ C.$ in a steam-jacket, by which means the absence of liquid or gaseous inclusions and of free sulphur in the sublimate was assured.

Measurements of crystals of this substance have hitherto only twice been recorded. Sixty years ago J. Nicklès² as the result of some comparatively rough observations—the values of the interfacial angles being given to half degrees only—concluded that the symmetry was orthorhombic and hemimorphic.

More than half a century later E. Artini³ showed that the crystals are really monoclinic in symmetry, though nearly orthorhombic in angles, and found the following fundamental constants:—

$$a : b : c = 0.8806 : 1 : 0.8480 ; \beta = 90^\circ 40'.$$

Five forms were observed (100), (001), (110), ($\bar{1}01$), (011), of which the first three were well developed, while ($\bar{1}01$), though common, was small, and (011) both small and rare. Simple crystals were met with, but generally they were twinned with respect to ($\bar{1}01$) or (101), in the shape either of distinct individuals or of polysynthetic twins.

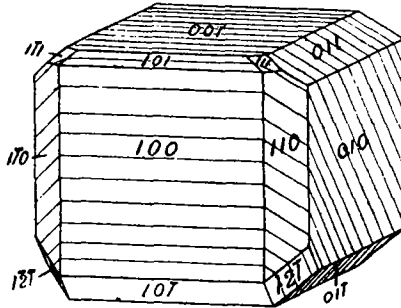
¹ F. P. Burt, Proc. Roy. Soc., London, 1911, vol. lxxxv, pp. 82-98.

² J. Nicklès, 'Sur la forme cristalline du sulfure d'azote,' Ann. Chim. Phys., 1851, ser. 3, vol. xxxii, pp. 420-421.

³ E. Artini, 'Sulla forma cristallina del solfuro d'azoto (N_4S_4),' Rend. R. Ist. Lombardo di Sci. e Lett., Milan, 1904, ser. 2, vol. xxxvii, pp. 864-869; abstract, Zeits. Kryst. Min., 1906, vol. xlii, pp. 68-69.

Measurements made on the present crystals agree closely with those recorded by Artini. By taking the most reliable values the fundamental constants were calculated to be

$$a : b : c = 0.8879 : 1 : 0.8480 ; \beta = 90^{\circ} 23'.$$



Crystal of nitrogen sulphide showing twin-lamination parallel to (101).

On all the crystals examined the faces were thickly striated owing to polysynthetic twinning about (101) (see fig.), this face alone being the exception, and the consequent spreading out of the reflected images tended to render some of the observations uncertain. No simple crystals or twin crystals with distinct individuals were observed.

The crystals are orange-red, but their powder is straw-yellow in colour. They are transparent and brilliant when fresh, but lose their lustre on exposure to damp air. In shape they resemble bevelled cubes, and they measure about 1 mm. across. They are much intergrown, but readily separate, the cavity left by a crystal removed being lined with brilliant faces. In addition to all the forms noted by Artini, the following new forms were observed, (010), (101), (210), (111), (121).

Five crystals were measured, but only the most reliable readings are recorded in the following table:—

Angle.	Calculated.	Observed Mean.	No.	Observed Angles.
100 : 001	—	89° 37'	2	89° 36', 89° 38'
100 : 110	—	41 36	2	41 36
100 : 210	23° 56'	23 23	1	—
100 : 101	—	46 31	2	46 31
100 : 101	46 7	46 0	1	—
010 : 011	49 44	49 44	2	49 41, 49 47
010 : 121	39 6	39 4	2	39 4
010 : 111	58 34	58 55	2	58 45, 59 5

Through the face $(\bar{1}01)$ a biaxial interference-figure with wide axial angle, the 'eyes' being far outside the field of view, was visible: the plane of the optic axes is parallel to the plane of symmetry, and the double refraction is strong and positive in sign. Approximate determinations were made of the refractive indices close to the direction of minimum deviation through the prism formed by the faces $(10\bar{1})$ and (001) , and the following values obtained:—

2.046, the plane of polarization of the ray being parallel to the face (010) .

1.908, the plane of polarization of the ray being perpendicular to the face (010) .

The former is therefore the value of the mean, while the latter is near the least, and the acute bisectrix is the greatest axis of the indicatrix. These values are close to those of rhombic sulphur.
