Three New Synthetic Minerals with Tohdite-like Structures

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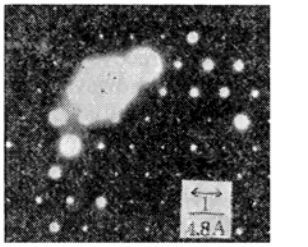
A new mineral, tohdite $5Al_2O_3 \cdot H_2O$, has been reported in previous papers.[1,2] The present authors have synthesized three more new minerals with tohdite-like structures, they have been named deuterium tohdite, rhombic tohdite and lithium tohdite.

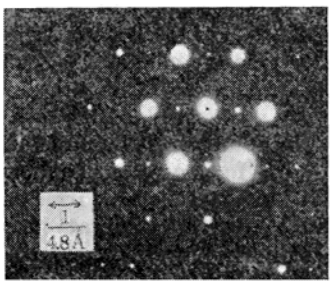
Deuterium Tohdite, $5Al_2O_3 \cdot D_2O$.—Deuterium boehmite AlOOD was obtained from eta-alumina when it was treated with D_2O in a Morey-type autoclave at 350°C under 150 atm. Then the deuterium boehmite was again treated hydrothermally with D_2O and a small amount of AlF_3 as a mineralizer at 480°C under 1000 atm. for 20 hr. In this process deuterium boehmite was converted into deuterium tohdite.

Deuterium tohdite is distinguished from normal tohdite by its infrared absorption spectra. Absorption bands are found at 2440 cm^{-1} for the OD-stretching mode and at 1080 cm^{-1} for the OH-deformation mode (for normal tohdite, the locations are at 3260 cm^{-1} and 1140 cm^{-1} for the OH stretching and deformation modes respectively).

Rhombic Tohdite, the Orthorhombic Form of $5Al_2O_3 \cdot H_2O$.—Boehmite AlOOH was treated hydrothermally with a small amount of AlF_3 at 480°C under 300 atm. for 40 hr. In the product rhombic tohdite was found. Rhombic tohdite is characterized by an electron diffraction pattern which shows an orthorhombic symmetry (Fig. 1).



(a)



(b)

Fig. 1. *N*-Patterns of normal tohdite (a) and rhombic tohdite (b) (electron beam ∥ c-axis).

Lithium Tohdite, $5Al_2O_3 \cdot LiHO$. — Lithium aluminate gel was precipitated by ammonium hydroxide from an aqueous solution of lithium chloride and aluminum chloride (1 : 5). The precipitate was then washed, dried, and treated hydrothermally at 400°C under 200 atm. for 20 hr. Lithium tohdite was formed in this treatment.

Chemical analysis showed that the lithium tohdite was 1.69% water and 2.78% lithium oxide, and NMR measurement did not detect the existence of any fluorine. Therefore, the chemical formula was determined to be $5Al_2O_3 \cdot LiHO$.

The refractive index and the density were 1.726—1.730 and 3.73 respectively.

The infrared absorption bands are found at 3310 cm^{-1} for the OH-stretching mode and at 1130 cm^{-1} for the OH-deformation mode.

The X-ray powder diffraction pattern is similar to that of normal tohdite except for slight differences in the *d*-values. The electron diffraction pattern shows a pseudo-hexagonal orthorhombic symmetry, as is shown in Fig. 2. The pseudo-hexagonal lattice dimensions were determined to be $a=5.57$ Å and $c=8.87$ Å. (For normal tohdite, they are $a=5.576$ and $c=8.768$.)

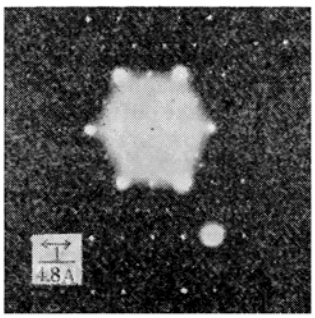


Fig. 2. *N*-Pattern of lithium tohdite (electron beam ∥ c-axis).

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1) G. Yamaguchi, H. Yanagida and S. Ono, This Bulletin, 37, 752 (1964).
2) G. Yamaguchi, H. Yanagida and S. Ono, ibid., 37, 1555 (1964).