

NOTES AND NEWS

FORMATION AND PROPERTIES OF SYNTHETIC THORITE CRYSTALS*

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Naturally occurring tetragonal thorite (ThSiO_4) is usually found in various states of metamictness as shown by its poor x -ray diffraction pattern, weak to absent birefringence, low refractive indices, and low density. Pabst has shown that progressive changes in these properties (except birefringence) occur with heating (Pabst, 1952). However, because of the complex nature of the annealing process it is not a simple matter to recognize the properties of non-metamict tetragonal thorite.

Euhedral crystals of tetragonal thorite up to 1 mm. in diameter have been grown from a 55 mole % ThF_4 -45 mole % KThF_6 eutectic mixture which melts at 875°C . (Asker, Segnit, and Wylie, 1952). To approximately 0.2 g. of this mixture, 0.11 g. of powdered ThO_2 and 0.04 g. of powdered vitreous silica were added. The contents were placed in a $\frac{1}{4}$ " O.D. \times 1.5" Monel cup, an argon atmosphere introduced and lid welded to the top of the cup. The sample was then heated in a muffle furnace for 13 days at 920°C . and slowly cooled to room temperature over a period of 2 days. The thorite crystals formed could be separated by prying the surrounding material away with a razor blade.

The transparent colorless crystals are approximately equi-dimensional square di-pyramids, prism faces are present only as narrow bands. Dichroism is present, X =pale green, Z =blue-green, $Z > X$. Refractive indices for sodium light are: $\omega = 1.823$, $\epsilon = 1.888$, ± 0.003 . It is interesting to note that there are few reported occurrences of natural thorite with optical properties similar to this synthetic preparation. The detrital crystals from Nettuno, Rome examined by Bonatti and Gallitelli (Bonatti and Gallitelli, 1951), are believed to be perfect and unaltered, contain only a "small amount" of uranium, and have slightly higher refractive indices with $\omega = 1.837$ and $\epsilon = 1.898$. Hutton determined the refractive indices on crystals of uranothorite (11.5 wt. % UO_2) from South Island, New Zealand to be $\alpha = 1.82$, $\gamma = 1.84$ (Hutton, 1950). Pabst has obtained single crystal x -ray diffraction photographs of Hutton's crystals and interpreted them to represent unaltered material, although a streaking along "powder arcs" is pointed out (Pabst, 1951).

Several synthetic thorite crystals weighing 8.42 mg. were mechanically cleaned and their volume determined by measuring the displacement of the meniscus of butyl phthalate in a precision-bore glass capillary. The

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density at 25° C. = 6.70 ± 0.1 which compares favorably with the theoretical x -ray density of 6.67 ± 0.01 .

Weissenberg photographs taken on a selected single crystal showed sharp diffraction maxima indicative of well-formed crystals. The cell dimensions determined from these photographs are:

$$\begin{aligned} a_0 & 7.17 \text{ \AA} \pm 0.03 \text{ \AA} \\ c_0 & 6.43 \text{ \AA} \pm 0.03 \text{ \AA} \end{aligned}$$

Cell dimensions determined from precision powder photographs are:

$$\begin{aligned} a_0 & 7.142 \text{ \AA} \pm 0.004 \text{ \AA} \\ c_0 & 6.327 \text{ \AA} \pm 0.003 \text{ \AA} \end{aligned}$$

The detailed results of structural x -ray diffraction studies of this material have been prepared in collaboration with Elizabeth Gebert of this laboratory and appear.

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A SIMPLE FUSION METHOD FOR DETERMINATION OF PLAGIOCLASE FELDSPAR FROM THIN SECTION

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The procedure described below is essentially a modification of the method described by Foster (1955) for determination of plagioclase feldspars by fusion. It is essential in this method to ascertain that the material to be melted is free from inclusions which would cause variation of the refractive index of the glass. Examination of a thin section of the plagioclase will show whether or not that particular section is free of included material. Therefore, it is necessary to be able to fuse a particular section of plagioclase by a method which should be simple to carry out on apparatus readily available to any petrographer.

This method requires that a small flake of the feldspar is melted and rapidly cooled to a glass. This can be done by fusion of the feldspar at the tip of an electrode from which a discharge is passing.