

Thorutite**(Th, U, Ca)Ti₂(O, OH)₆**

Crystal Data: Monoclinic; always metamict. *Point Group:* 2, *m*, or 2/*m*. As short prismatic crystals, to 2 cm.

Physical Properties: *Fracture:* Conchoidal. Hardness = 5-6 *D*(meas.) = 5.82; 6.0(5) (synthetic ThTi₂O₆). *D*(calc.) = [5.65]; 6.08 (synthetic ThTi₂O₆).

Optical Properties: Translucent. *Color:* Black; brown on thin edges. *Streak:* Pale brown.

Luster: Resinous.

Optical Class: Isotropic. *n* = > 2.1

Cell Data: *Space Group:* C2, *Cm*, or C2/*m* (synthetic ThTi₂O₆). *a* = 9.822(5) *b* = 3.824(2) *c* = 7.036(5) *β* = 118.84(5)° *Z* = 2

X-ray Powder Pattern: Kutuyur-Tyube deposit, Russia; after heating at 1000 °C. 3.17 (7), 1.728 (6), 1.695 (6), 1.632 (3), 2.72 (2), 1.226 (2), 4.35 (1.5)

Chemistry:	(1)
UO ₃	0.14
Nb ₂ O ₅	1.12
Ta ₂ O ₅	0.08
SiO ₂	0.44
TiO ₂	36.1
ThO ₂	54.10
UO ₂	1.43
Al ₂ O ₃	1.50
Fe ₂ O ₃	1.10
CaO	1.07
H ₂ O	0.94
<u>LOI</u>	<u>1.72</u>
Total	99.74

(1) Kutuyur-Tyube deposit, Russia; corresponds to (Th_{0.87}Ca_{0.08}Fe²⁺_{0.06}U⁴⁺_{0.02})_{Σ=1.03}(Ti_{1.92}Al_{0.09}Nb_{0.03})_{Σ=2.04}(O, OH)₆.

Polymorphism & Series: Forms a series with brannerite and a limited series with loparite.

Occurrence: In veins of microcline and sericitized nepheline, in a syenite massif.

Association: Thorite, zircon, calcite, barite, galena.

Distribution: Kutuyur-Tyube thorium deposit, near Urusai Peak, Sokh River basin, Alai Range, Kyrgyzstan.

Name: For the composition, THORium, Uranium, and TITanium.

Type Material: All-Union Research Institute of Mineral Resources, Moscow, Russia.

References: (1) Gotman, Y.D. and I.A. Khapaev (1958) Thorutite - a new mineral of the group of titanites of thorium. *Zap. Vses. Mineral. Obshch.*, 87, 201-202 (in Russian). (2) (1958) *Amer. Mineral.*, 43, 1007 (abs. ref. 1). (3) Povilaitis, M.M. (1963) On the new minerals lodochnikite, absite, and thorutite. *Zap. Vses. Mineral. Obshch.*, 92, 113-123 (in Russian). (4) Ruh, R. and A.D. Wadsley (1966) The crystal structure of ThTi₂O₆ (brannerite) [= thorutite]. *Acta Cryst.*, 21, 974-978. (5) Mitchell, R.H. and A.R. Chakhmouradian (1999) Solid solubility in the system NaLREETi₂O₆ - ThTi₂O₆ (LREE, light rare-earth elements): experimental and analytical data. *Phys. Chem. Minerals*, 26, 396-405.