UniSoft NT Ltd

Machine for single crystal growth

Region of application

The machine is primarily for growing single crystals by the "Flax" method. This method is unique when: the compound melts with decomposition; has polymorphic transitions; has volatile components at high temperature; crystals with minimal internal stresses are required; or other specific properties are required.

Approximately 70% of inorganic compounds have to be grown by this method.

The apparatus also covers the "Czochralski" and "Kyropolus" methods at melting temperatures up to 1200°C.

A number of aluminates, silicates, germanates, tungstates, vanadates, borates, etc. can be grown. Single crystals are primarily intended for laser technology. Some of them are solid-state laser active media, and others are nonlinear optical materials for converting laser radiation.

Examples of laser active media: barium titanate ($BaTiO_3$), aluminum tungstate $Al_2(WO_4)_3$, potassium gadolinium tungstate $(KGdWO_4)_2$, potassium yttrium tungstate $(KGdWO_4)_2$, yttrium vanadate (YVO_4), etc.

Examples of nonlinear optical media: barium borate (BaB_2O_4), cesium lithium borate ($CsLi\ B_3O_6$), lithium triborate (LiB_3O_5), potassium titanyl phosphate ($KTiOPO_4$), etc.

Technological parameters

Due to the diverse properties of different substances, the growth of single crystals from them requires equipment with a wide range of each of the technological parameters:

- Growth in the temperature range from 500 to 1200°C.
- Heating (cooling) rate from 0.05 to 5.0°C/hour.
- Revolutions of crystal rotation from 1 to 100 rpm (with an option for reverse rotation according to a set program).
- Temperature gradients in the melt from 1 to 20 °C/cm; crystal lifting speeds during growth from 15 to 1500 μm.
- Options for rapid cooling as well as rapid crystal lifting.
- Options for growing single crystals in air, inert, reducing, and oxidizing environments, as well as in vacuum.

The equipment includes:

- Three-zone resistance furnace up to 1200 ° C.
- A precise three-channel temperature programmer with separate programs for each zone and temperature maintenance accuracy +/- 0.02 degrees.
- A precise mechanism for lifting the crystal during growth.
- A precision crystal rotation mechanism.
- Optical system for continuous diameter control and feedback with the temperature program: working chamber size diameter from 50 to 200 mm and height from 50 to 70 cm according to the request.

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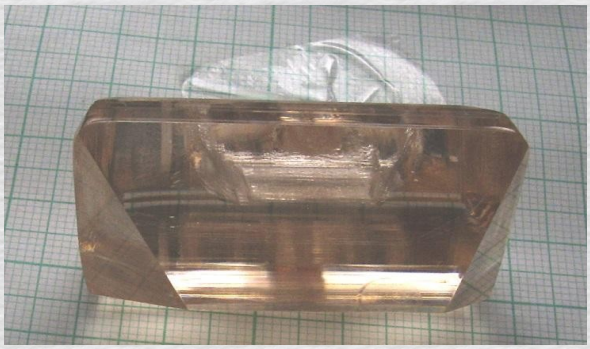
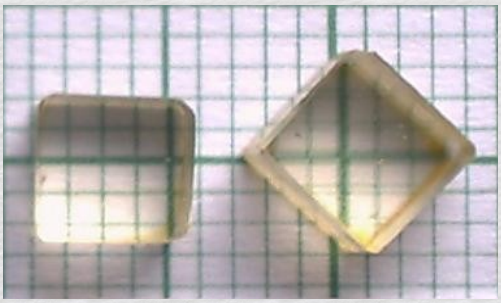
Examples of grown crystals

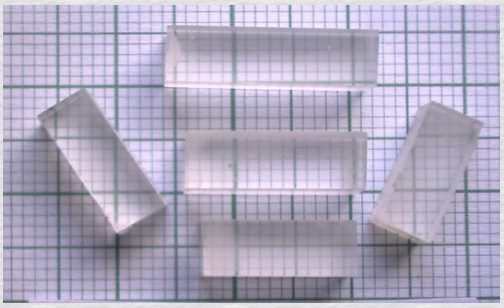


$KTiOPO_4$ single crystal
Potassium titanyl phosphate - nonlinear optical crystal.

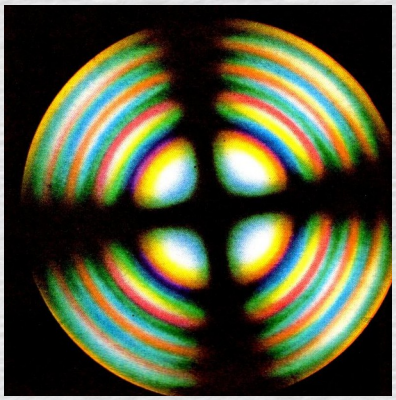
$KYb_{0,9}Tm_{0,1}(WO_4)_2$ single crystal
Potassium yttrium tungstate doped with 10 atomic % thulium - laser crystal.



β – BBO THG 1064 – 355nm
Barium borate - nonlinear optical crystal. Elements for converting laser radiation from 1064 nanometers to 532 nanometers.



β – BBO EOM 4.5 x 5 x 11-18 nm
Barium borate. Elements for optical parametric oscillators.



Interference picture of beta BaB_2O_4 single crystal
Indicates a very high quality of the crystal. Any defect would deform the interference.

$NaAl(WO_4)_2$
Sodium aluminum tungstate. Laser crystal.

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