

Novel electro-optic single crystal materials

Keywords: crystal growth, crystal chemistry, electro-optical applications

Kiyoshi Shimamura

Optical Materials Field / Optical Single Crystals Group

SHIMAMURA.Kiyoshi@nims.go.jp | http://www.nims.go.jp/group/oscg/index_e.html



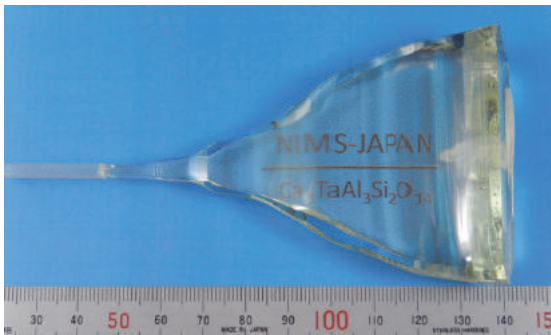
Background

Single crystals have played an important role in the technological developments of current life standards. At present, novel electro-optic single crystal materials are highly demanded to achieve a more sustainable and environmental friendly society.

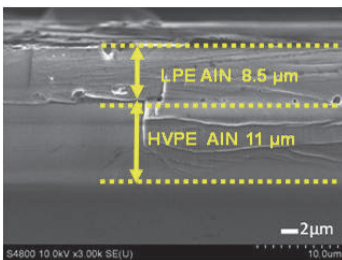
Aim

The aim of the research is to design novel functional electro-optic single crystals that meet the industrial demands. For it, in close-relationship with industrial partners, firstly a basic research is carried out (crystal engineering to compromise properties), and secondly the development proceeds till the demonstration of device prototypes.

Advanced Research Topics

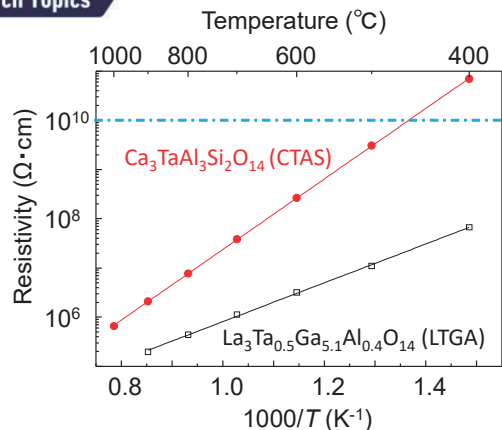


Piezoelectric $\text{Ca}_3\text{TaAl}_3\text{Si}_2\text{O}_{14}$ (CTAS) single crystal.



AlN crystalline film fabricated by the LPE technique, for high quality standing free substrate.

AgGaS₂, Chalcogenide, as an example of novel single crystal exploration for IR optical applications.



High resistivity of CTAS at 400°C, which contrast with the low values of LTGA as a reference.

Publications

$\text{Ca}_3\text{TaAl}_3\text{Si}_2\text{O}_{14}$ Single Crystals : Crystal Growth & Design, 16 (2016) 2151-2156.

$\text{Ca}_3\text{TaGa}_{3-x}\text{Al}_x\text{Si}_2\text{O}_{14}$ Single Crystals : Journal of Alloys and Compounds 687 (2016) 797-803.

$\text{Ca}_3\text{TaGa}_3\text{Si}_2\text{O}_{14}$ Single Crystals : Journal of the Ceramic Society of Japan 124 (2016) 523-527.

Applied area and future prospects

- Combustion pressure sensors for fuel-efficient and clean exhaust gas.
- High temperature sensors which conventional piezoelectric materials cannot realize.
- Exploration of new material and applications in the field of semiconductor and IR optics.

Issues for technology transfer

- Fabrication of proto-types for fuel combustion sensors and high temperature sensors.
- Growth of 2 inch large size single crystals.
- Detailed characteristics in IR wavelength region and device fabrication