INSTITUT NÉEL Grenoble

Topic for Master 1 internship – Academic year 2021-2022

Optical rotation angles and optical rotatory dispersion of α - GeO_2 crystals

General Scope:

α - GeO_2 crystals, which are isostructural to quartz (α - SiO_2), are grown at Institut Néel by a high temperature flux method (Figure 1a). It is one of the promising piezoelectric materials to be used for high temperature applications [P. Papet *et al.*, *J. Appl. Phys.* **126**, 144102 (2019)] and in nonlinear optical devices [T. Remark *et al.*, *Opt. Mater. Express*. in press].
Some of the as grown crystals shows optical twins (*Brazil* twins) which are a drawback for the use of α - GeO_2 crystals in some of its applications. These twins have been visualized and characterized by optical microscopy and X-ray topography (figure 1c-d) at Institut Néel in thin slabs. Recently measurements of the optical activity have been used to demonstrate the existence of optical twins in $YAl_3(BO_3)_4$ (YAB) and $K_2Al_2B_2O_7$ (KABO) crystals [J. Buchen *et al.*, *Crystals* **9(1)**, 8 (2019)], and could then be used to assess crystal quality and to select twin-free zones of α - GeO_2 crystals.

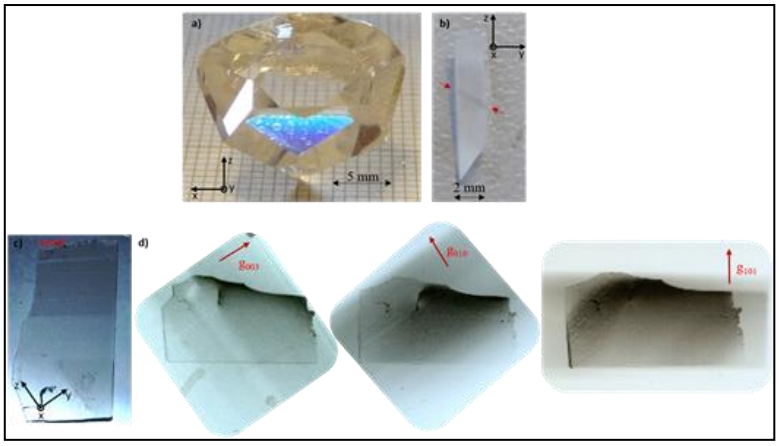

Fig. 1: a) Bulk α-GeO_2 single crystals grown by Top Seeded Solution growth and b) an oriented crystal seed use for crystal growth. Red arrows indicate the position of an optical twin revealed by etching. c) Optical microscopy image of a thin X-slab and d) x-ray traverse topography of different reflections.

Research topic and facilities available:

Changes in the sign and magnitude of optical rotation angles in thick α - GeO_2 slabs oriented along the optical axis could give us information about the presence and extension of optical twins. During the internship the space-resolved measurements of the optical rotation angles, which is known to be of the order of 30 deg/mm at 633 nm, as well as optical rotatory dispersion will be done whether by using a spectrophotometer with rotatable polarizers or by using an accordable laser source available at Institut Néel.

Possible collaboration and networking:
Teams involved in the ANR OVERHEAT project

Required skills:
Strong interest in optical characterizations is needed. Skills in data analysis as well as interest in materials science will be appreciated

Starting date: February/March 2022

Contact:
Name : Alexandra Peña Revellez / Corinne Félix / Bertrand Ménaert
Institut Néel - CNRS
Phone : 0 476 88 79 41 e-mail : alexandra.pena@neel.cnrs.fr

More information : https://neel.cnrs.fr/equipes-poles-et-services/optique-et-materiaux-optima
https://neel.cnrs.fr/equipes-poles-et-services/optique-microscopies
https://neel.cnrs.fr/equipes-poles-et-services/cristaux-massifs