

Optimization of the solution composition to grow the chiral ferromagnet α -LiFe₅O₈ from high temperature solutions

General Scope:

LiFe₅O₈ (LFO) belongs to the ferrite family of materials and recently it has shown an effective magnetoelectric (ME) coupling effect, at relatively high temperatures (120-300 K), due to the fact that it possesses a large magnetization. The α form of LFO crystallizes in a B-site-ordered spinel structure with a cubic symmetry in the $P4_332/P4_132$ space group (fig. 1a) and it is chiral from a crystallographic and from a magnetic point of view. For some of the properties shown by LFO, such as the magneto-chiral dichroism, the obtained crystals should be homo-chiral because in racemic twin crystals this property is cancelled. For this reason, the determination of the growth conditions to obtain homo-chiral LFO crystals is important.

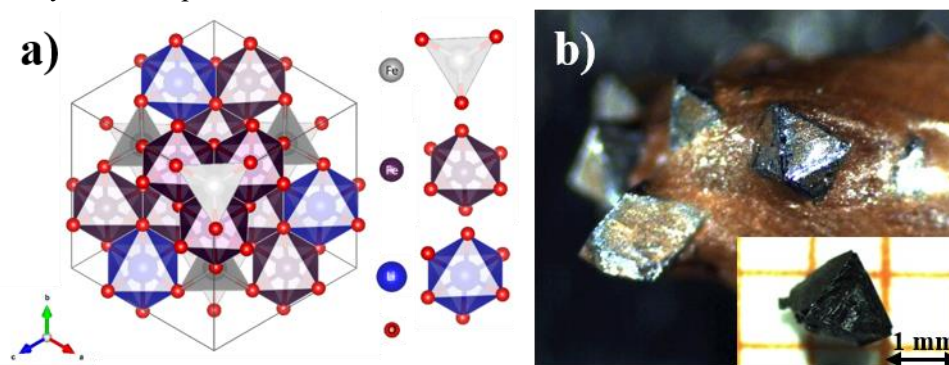


Figure 1: a) Crystallographic structure of α -LiFe₅O₈ and b) α -LiFe₅O₈ crystals obtained by spontaneous nucleation from a solution with a composition 0.08Fe₂O₃-0.42B₂O₃-0.5Li₂O.

Research topic and facilities available:

Recently we have grown mm size α -LiFe₅O₈ crystals (fig. 1b) but the structure determination done by X-ray showed that the obtained crystals were racemic. So, the main objective of this internship is to optimize/change the solution composition used so far in order to obtain homo-chiral α -LiFe₅O₈ crystals. The growth method, used during the internship, will be a high temperature flux one. The growth devices are available in the technical services (*pôle Cristaux Massifs* of MCBT department). The different characterization of the obtained crystals will be done mainly by Scanning Electron Microscopy (SEM) and X-ray diffraction (*pôle POM* and *X'Press* of PLUM department).

Possible collaboration and networking: Hiroshima University

Possible extension as a PhD: Possible if any financial support is found.

Required skills: Strong interest in materials science and experimental work is needed. Skills in crystal growth will be appreciate.

Starting date: February/March 2020

Contact:

Name: Alexandra Peña Revellez & Bertrand Ménaert

Institut Néel - CNRS

Phone: 0476887941 e-mail: alexandra.pena@neel.cnrs.fr & bertrand.menaert@neel.cnrs.fr

More information: <http://neel.cnrs.fr>