EUROPEAN SYNCHROTRON RADIATION FACILITY

INSTALLATION EUROPEENNE DE RAYONNEMENT SYNCHROTRON

ESRF

Experiment Report Form

The double page inside this form is to be filled in by all users or groups of users who have had access to beam time for measurements at the ESRF.

Once completed, the report should be submitted electronically to the User Office via the User Portal: *https://wwws.esrf.fr/misapps/SMISWebClient/protected/welcome.do*

Deadlines for submission of Experimental Reports

Experimental reports must be submitted within the period of 3 months after the end of the experiment.

Experiment Report supporting a new proposal ("relevant report")

If you are submitting a proposal for a new project, or to continue a project for which you have previously been allocated beam time, you must submit a report on each of your previous measurement(s):

- even on those carried out close to the proposal submission deadline (it can be a *"preliminary report")*,
- even for experiments whose scientific area is different form the scientific area of the new proposal,
- carried out on CRG beamlines.

You must then register the report(s) as "relevant report(s)" in the new application form for beam time.

Deadlines for submitting a report supporting a new proposal

- 1st March Proposal Round - **5th March**
- 10th September Proposal Round - **13th September**

The Review Committees reserve the right to reject new proposals from groups who have not reported on the use of beam time allocated previously.

Reports on experiments relating to long term projects

Proposers awarded beam time for a long term project are required to submit an interim report at the end of each year, irrespective of the number of shifts of beam time they have used.

Published papers

All users must give proper credit to ESRF staff members and proper mention to ESRF facilities which were essential for the results described in any ensuing publication. Further, they are obliged to send to the Joint ESRF/ ILL library the complete reference and the abstract of all papers appearing in print, and resulting from the use of the ESRF.

Should you wish to make more general comments on the experiment, please note them on the User Evaluation Form, and send both the Report and the Evaluation Form to the User Office.

Instructions for preparing your Report

- fill in a separate form for each project or series of measurements.
- type your report in English.
- include the experiment number to which the report refers.
- make sure that the text, tables and figures fit into the space available.
- if your work is published or is in press, you may prefer to paste in the abstract, and add full reference details. If the abstract is in a language other than English, please include an English translation.

ESRF	**Experiment title:** EXAFS study of ferroelectric topological crystalline insulators	**Experiment number:** **HC-5246**
Beamline: BM23	**Date of experiment:** from: May 3rd 2023 to: May 9th 2023	**Date of report:**
Shifts: 18	**Local contact(s):** Raffaella Torchio	*Received at ESRF:*

Names and affiliations of applicants (* indicates experimentalists):

***Ondrej Caha**, Department of condensed matter physics, Masaryk University, Brno, Czechia

Gunther Springholz, Institute of semiconductor and solid state physics, Johannes Kepler University, Linz, Austria

***Lakshmi Sajeev,** Department of condensed matter physics, Masaryk University, Brno, Czechia

***Petr Mikulik,** Department of condensed matter physics, Masaryk University, Brno, Czechia

Report:

A series of ferroelectric epitaxial films with variou composition were analyzed using EXAFS at temperatures below and above phase transition.
We have studied two series of (Pb,Sn)Te and (Pb,Ge)Te pseudobinary alloy samples with varying Sn and Ge concentration. The samples were epitaxial thin films grwon on BaF_2 (111) substrates. The inceasing Sn or Ge concentration incereases ferroelectric critical temperature. The EXAFS data shows anomalous behaviour of the nearest neighbor distances below critical temperature corresponding to the ferroelectric phase transition. The comparison of the Pb and Sn beahvior will help us to explain the nature of the ferroelectric transition. The data are still under detaialed analysis.

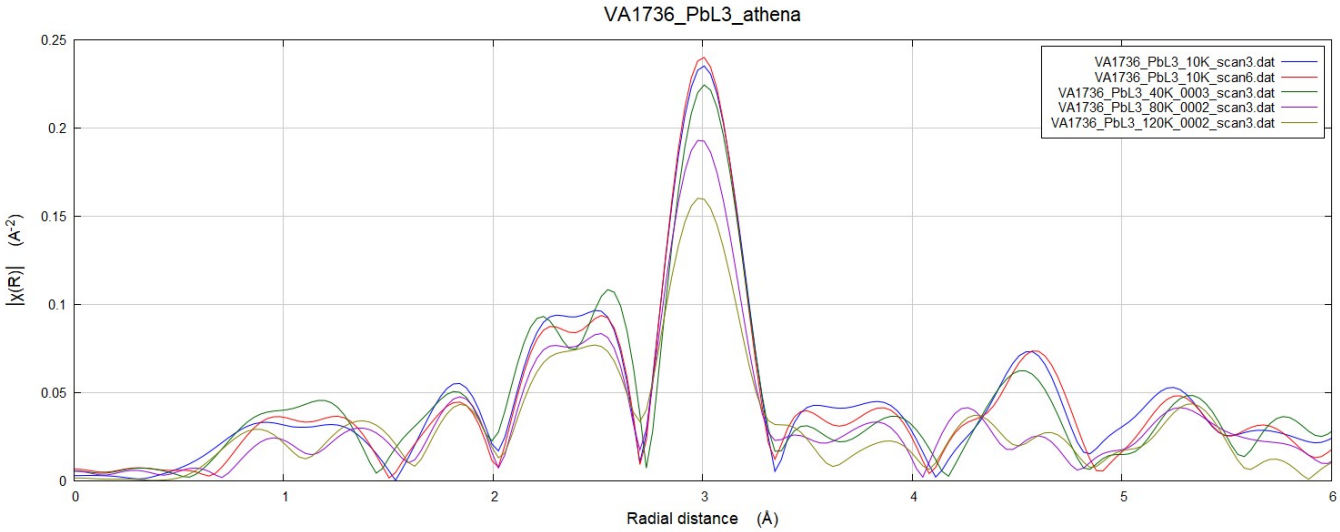


Fig 1: Fourier transform of EXAFS at Pb L3 edge of $Pb_{0.65}Sn_{0.35}Te$. The Tc is around 80K. The distance of nearest neighbor atoms shows decrease with temperature below Tc.

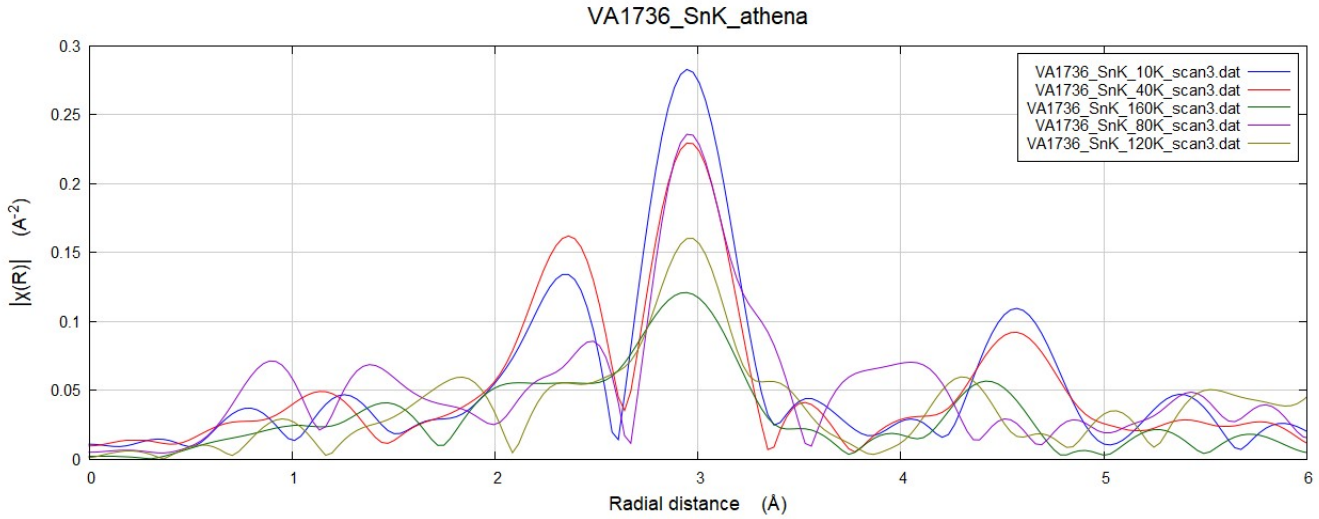
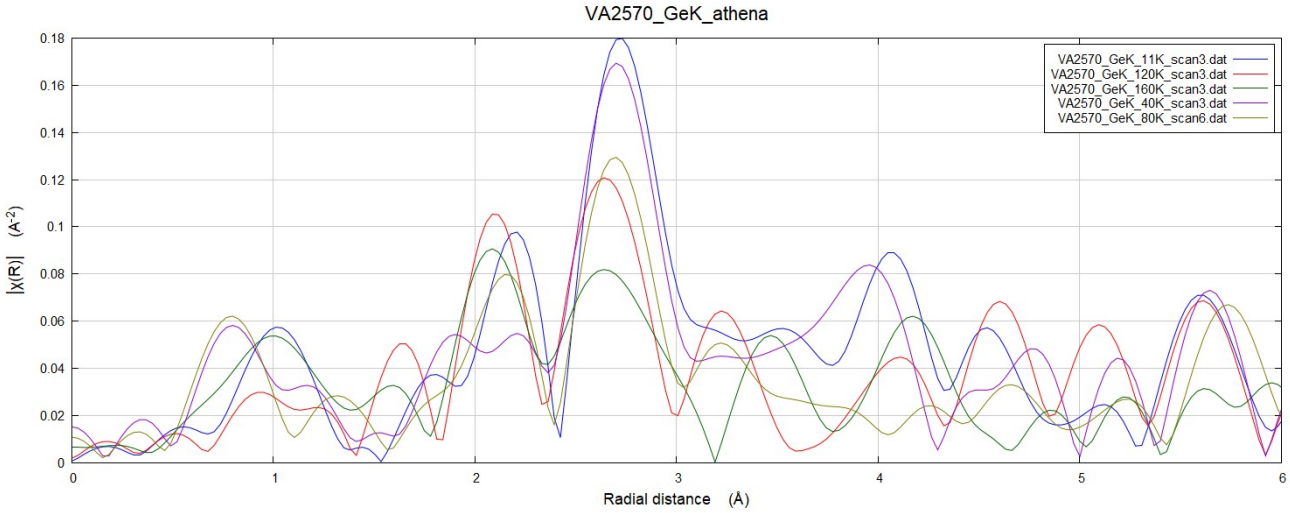


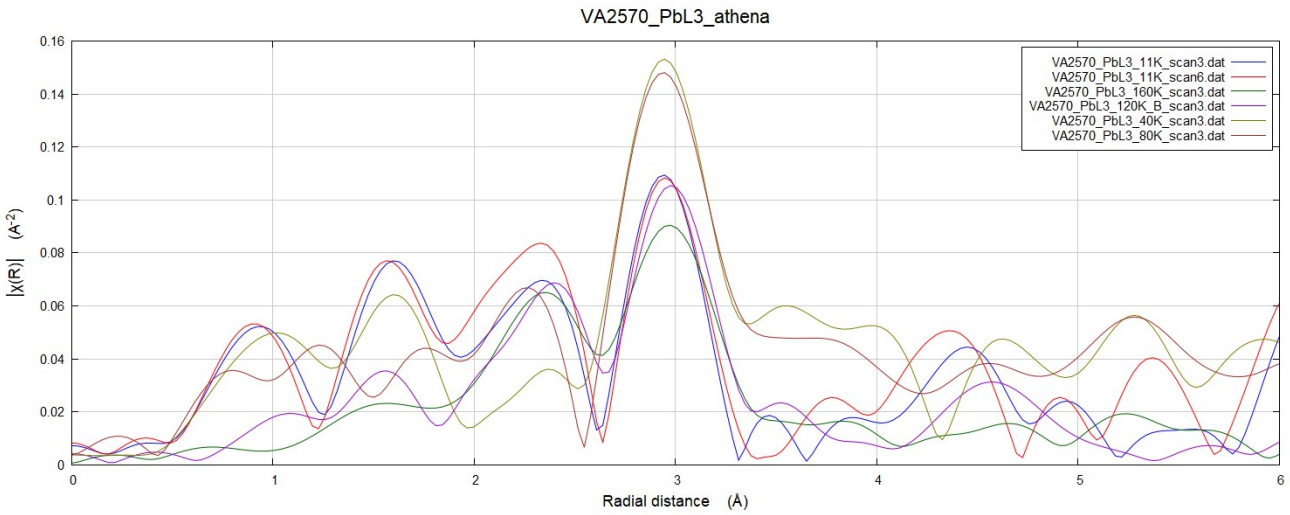
Fig 2. Fourier transform of EXAFS signal at Sn K edge on $Pb_{0.65}Sn_{0.35}Te$ sample.

Fig 3.



Fourier transform of EXAFS signal at Ge K edge on $Pb_{0.94}Ge_{0.06}Te$ sample. Tc is at 170K.

Fig 4.



Fourier transform of EXAFS signal at Pb L_3 edge on $Pb_{0.94}Ge_{0.06}Te$ sample.