Seminar Announcement

Dr. Carmelo Prestipino

Universiy of Rennes -1

Complex crystallography for thermoelectric materials: the case of silicides and germanite

Monday, 24 October 2022, h. 14.30

Sala Wataghin, Physics Department, via P. Giuria 1, Torino

The speaker

Carmelo Prestipino is a crystallographer working on solid state chemistry as CNRS researcher at the Institut of Science Chimique de Rennes. He has a 15 years of experience on characterization of complex materials. He is member of the board of French crystallographic association.

Abstract

Thermoelectric (TE) generators are all-solid-state devices that enable the conversion of heat, including heat losses, into electricity thanks to the Seebeck effect. Important research efforts have been undertaken during the past two decades to increase TE efficiency of numerous materials such as Bi_2Te_3, $GeTe_2$ or $PdTe_3$ to enable a more extensive development of TE technology. However, many other factors must be taken into account when selecting materials for TE generators, such as the raw material costs and toxicity, mechanical properties, chemical and thermal stability, and thermal expansion coefficients.

For all these reasons, silicides (HMS phases and β-$FeSi_2$) and copper sulfide derivate from mineral phases are considered as promising industrial thermoelectric materials for the mid-temperature applications (600 - 800 K). However, one of the main obstacles for their more diffuse application remains the finer understanding of the properties/structure relationship, also due to their intrinsic structural complexity. In this context, X-ray and electron diffraction are fundamental tools for their structural study, and the talk will illustrate their contribution for three typical cases: a) incommensurately composite structure $MnSi_{1.74}$, b) the contribution of stacking fault for β-$FeSi_2$ c) the use of anomalous diffraction to determine the cation ordering in germanite.

Ref. Marco Truccato