28 March 2022

PhD contract offer

Subject: Electrodeposition and characterizations of thermoelectric films based on earth-abundant elements

General information

Workplace: Institut Jean Lamour (Metz) and LEMTA (Nancy), France
Type of contract: PhD contract
Contract period: 36 months
Expected date of employment: October 2022
Proportion of work: Full time
Remuneration: Around 1.975 € / month
Desired level of education: Master degree in physics, material science, or physical-chemistry or a related field
Experience required: -

Subject description

The Institut Jean Lamour (IJL) of the Université de Lorraine (France) invites applications for a PhD position in materials Science.
This work is a part of the innovations aimed at improving the energy efficiency of thermoelectric materials through their nanostructuring.
Thermoelectricity (TE) is one of the most promising way for energy harvesting and must be considered as a valuable solution in renewable clean energy source as photovoltaic devices and wind turbines. Despite all the possible applications, TE still suffers from a lack of interest in industries and large-scale applications due to limited efficiencies. Moreover, for applications at room temperature; the reference materials, such as Bi_2Te_3, are expensive and remain toxics.
To overcome those major barriers, this PhD proposal will focus on a new class of TE IV-VI materials; Sn-based compounds. Their abundance on earth may open the way to large-scale industrial applications.

Missions

The work proposed in this PhD will meet various domains in Sciences and Material Engineering. TE Sn-based material will be synthesized using a chemical approach namely electrodeposition.
Various approaches to precisely control the stoichiometry, crystallinity and other important structural properties will be apprehended. The experimental synthetization part will be in-line theoretical calculations using with Monte Carlo methods to predict and tailor the properties of the compounds.
Then, a complete characterization methodology is proposed to measure the transport and TE properties of those new materials. Specifically, electrical measurements will be carried out using Van der Paw method and Seebeck coefficient will be measured.
Optical measurements will be carried out to get additional electronic properties by Spectroscopic Ellipsometry. Thermal characterization will also be considered by the means of the 3ω-ScanningThermal Microscope currently at LEMTA.

In addition to the proposed research work the candidate will also benefit from multidisciplinary teaching, lectures and training provided by the Université de Lorraine doctoral school.

Altogether, the work will provide a complete thermoelectric characterization of Sn based materials to enhance the efficiency of green-energy TE solutions.

Keywords

Electrodeposition, low dimensional materials, thermoelectricity, experimental characterization

Work context

The PhD position will take place at the Institut Jean Lamour (IJL) in Metz, in the research group Chemistry and Electrochemistry of Materials under the supervision of A. Pr. N. Stein (IJL) and Pr. D. Lacroix (LEMTA). He will join LEMTA (Nancy) for several months in order to be trained on Monte Carlo simulations and for thermal property characterizations by 3ω-SThM.

Skills

- Taste for practical work
- Knowledge of English (oral and written) is important and knowledge of French would be an advantage.
- As an enthusiastic researcher you like team work, and have a flexible approach to collaborating between different laboratories
- Due to the multi-disciplinary of the proposed work, the recruited candidate must have a solid background in chemistry and must be very interested in other domains in physics such as solid-state physics or optics. He will have a strong inclination to experimental works and must be very eager to learn various characterization methods.

Constraints and risks

The position you are applying for is located in a sector relating to the protection of scientific and technical potential. It therefore requires, in accordance with the regulations, that your arrival be authorized by the competent authority of the Ministry of Higher Education, Research and Innovation.

About Institut Jean Lamour

The Institut Jean Lamour (IJL) is a joint research unit (UMR 7198) of CNRS and Université de Lorraine
It is linked to the Institute of Chemistry of CNRS.
Focused on materials and processes science and engineering, it covers: materials, metallurgy, plasmas, surfaces, nanomaterials and electronics.
It regroups 183 researchers/lecturers, 91 engineers/technicians/administrative staff, 150 doctoral students and 25 post-doctoral fellows.
Partnerships exist with 150 companies and our research groups collaborate with more than 30 countries throughout the world.
Its exceptional instrumental platforms are spread over 4 sites; the main one is located on Artem campus in Nancy.

Application

Applicants are invited to send a résumé and cover letter together with diploma copies to:
David LACROIX **david.lacroix@univ-lorraine.fr**
Nicolas STEIN: **nicolas.stein@univ-lorraine.fr**