

Post-doctoral open position at ISCR

Deposition of thin films of chalcogenides PCM and their characterizations for the multi-reconfiguration of antennas and microwave circuits with independent electrical and optical control

A 6-months duration Post-Doctoral position in the field of materials science will start at [Institut of Chemical Sciences of Rennes](#) with a focus on the deposition of thin films of Phase Change Material (PCM) chalcogenides (Chg) and their characterizations (chemical composition, conductivity, crystallization, refractive index, etc.). This project devoted to the multi-reconfiguration of antennas and microwave circuits with independent electrical and optical control takes place in collaboration with the [IETR \(Institut d'Électronique et des Technologies du numéRiques\)](#). An 18-month extension could be considered at the end of these 6 months as part of the ANR MACIEO project.

PhD starting : July 2024

Duration : 6 months

Supervisors : V. Nazabal, L. Calvez, E.Fourn

Funding : DATERAC CominLabs project

Keywords : sputtering, DRX, XRR, conductivity, chalcogenide, PCM

Post-doctoral context

This post-doctoral position is part of a multidisciplinary project whose final objective is to propose new solutions to increase the reconfiguration capacities of antennas and microwave circuits for future civil or military communication systems: xG, IoT, satellite constellations, etc. For this, one of the main ideas is to take advantage of the properties of PCM Chg, which can exist in two phases: crystalline and amorphous at ambient temperature.

The candidate's main mission will be to monitor the progress of the project in materials sciences and participate experimentally in the manufacturing by PVD and characterization of thin layers of PCM Chg in collaboration with a CNRS engineer. The mission involves selecting chalcogenide materials, designing the deposition process and synthesizing RF-sputtered chalcogenide thin films with the desired electrical, mechanical, thermal and chemical performance. It also includes thermal or optical treatment to induce the reversible PCM Chg effect (mainly structural and electrical). The work is mainly experimental, with a focus on understanding the physical and chemical mechanisms determining the crystal growth and amorphization of chalcogenides and their impact on material performance. More specifically, its mission will concern the optimization of PCM Chg performance by favoring sufficient conductivity of the crystalline phase and a strong resistivity contrast between the amorphous and crystalline phase associated with an adequate PCM Chg film thickness to adapt them to reconfigurable microwave circuits. Placed alongside the scientific manager, CNRS Research Director, and a professor from the University of Rennes, the candidate will assist them in monitoring the smooth running of the project within the Institute of Chemical Sciences of Rennes (ISCR) in collaboration with the IETR lab as project leader.

The main activities of this project are:

- PCM Chg films development by favoring sufficient conductivity of the crystalline phase and a strong resistivity contrast between the amorphous and crystalline phase associated with an adequate film thickness to adapt them to reconfigurable microwave circuits and antennas;
- PVD deposition (co-sputtering and cathodic magnetron RF sputtering) of thin layers of chalcogenides;
- Characterization using X-ray diffraction/X-ray reflectometry techniques on thin films, microscopy (SEM/TEM – EDS etc.) on thin films;
- Characterization of the electrical resistivity of Chg thin films in both states and evaluation of their performance in terms of resistivity contrast;
- Thermal and mechanical characterization of the Chg thin films.
- Characterization of the chemical and optical properties of the thin layers: SEM, EDS, AFM, profilometry, transmission and reflection, refractive index by m-Lines and ellipsometry, XPS, Raman, IR, etc.;
-

About the Post-doctoral candidate

- Very good written English/effective publication writing;
- Skills: doctorate in physics or doctorate in chemistry (specialty: materials sciences, solid state physics);
- Advanced skills in the field of manufacturing thin films (ideally chalcogenides) by PVD (ideally co-sputtering);
- Advanced skills in the field of X-ray diffraction/X-ray reflectometry techniques on thin films, microscopy (SEM/TEM – EDS etc.) on thin films, characterization of electrical properties;
- Skills in the fields of thermal and mechanical properties of thin films and more generally solid physics and materials sciences;
- Ability to carry out scientific valorization: writing articles, presentations;
- Teaching skills, supervisory experience (interns, doctoral student);
- Ability to work in a team, curiosity and scientific monitoring, strong interest in the proposed project and field, good interpersonal skills.

Additional information - Contact

More information by contacting :

virginie.nazabal@univ-rennes.fr (ISCR), erwan.fourn@insa-rennes.fr (IETR lab)

How to apply

Contact: virginie.nazabal@univ-rennes.fr and erwan.fourn@insa-rennes.fr

Documents asked for :

- Motivation letter
- Detailed curriculum vitae (CV)
- Educational grades and marks (at university level)
- Recommendation letters or people to contact for recommendation.

Deadline for submission : 15th May 2024