

Postdoctoral position at the LMGP Laboratory in Grenoble

Development of memristive devices based on topotactic phase transitions

Role:

We are looking for a highly-motivated postdoctoral researcher to lead the research activity on the development and advanced characterization of redox-based memristive devices as candidates for future non-volatile memories and for artificial synapses in neuromorphic circuits. He/she will be part of the *Nanoionics group* led by Dr Mónica Burriel. He/she will work within the framework of the ANR-DFJ joint project “Memtop”, which aims to study the switching kinetics of memristive devices employing topotactic brownmillerite-perovskite phase transitions. The project will involve collaboration, interaction and short visits to the 2 partners in Germany: Prof. Dr. Roger A. De Souza’s group at RWTH Aachen and Prof. Regina Dittmann’s group at FZ-Jülich.

Context

Redox-based memristive devices are highly attractive candidates for future non-volatile memories and for artificial synapses in neuromorphic circuits. The memristive behavior is usually induced by the field-driven movement of oxygen ions leading to a local nanoscale redox reaction. In thin films of certain perovskites, such as manganites, ferrites and cobaltites, this redox process results in a topotactic phase transition between a conducting perovskite (PV) phase with disordered oxygen vacancies and an insulating brownmillerite (BM) phase with ordered oxygen vacancies. In such cases, the oxygen-ion transport kinetics are expected to determine the memristive device’s performance, in terms of switching speed, retention and plasticity of artificial synapses, but at present these ion transport kinetics are poorly understood.

Research activities

As part of this exciting project, the post-doctoral researcher will focus on tuning the structural and functional properties of perovskite/brownmillerite thin films using chemical deposition techniques (mainly MOCVD) and on characterizing them using a combination of advanced functional characterization techniques. For understanding and optimizing the memristive device’s performance in terms of switching speed, retention and plasticity of artificial synapses, it is mandatory to relate the structural, micro-structural and chemical parameters of the oxide to the oxygen-ion transport kinetics. The LMGP houses state-of-the-art experimental equipment for investigating such properties. Atomic force microscopy, electron microscopy (SEM, TEM), isotope exchange, *in situ* X-ray diffraction and *in situ* Raman spectroscopy will be used and combined with the electrical measurements of the memristive devices.

For this the postdoc will mainly in charge of the:

- Deposition, characterization and tuning of perovskite/brownmillerite thin films
- Design and fabrication of memristive devices (cleanroom)
- Advanced electrical and operando characterisation of memristive devices
- Development and implementation of *in situ* characterization techniques
- Project management: organization of meetings, presentations and report writing

Requirements:

- PhD degree in materials science, physics, chemistry or related field

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Research profile:

- Knowledge in materials science and particularly in oxides for memory applications
- Experience in oxide thin film deposition
- Experience in characterisation of oxide thin films, including diffraction (XRD, XRR, RSM), electron microscopy (SEM, EDX and TEM), Atomic Force Microscopy (AFM), X-ray photoelectron spectroscopy (XPS), ellipsometry and/or Raman spectroscopy
- Experience in electrical and electrochemical measurements of functional materials and memr devices
- Computing and programming skills (Python, Matlab and/or Labview)

Highly desirable

- Experience in Synchrotron characterizations techniques (eg. XAS, HAXPES, XRD)
- Experience in clean room microfabrication

Required skills:

- A very good knowledge of English language, both spoken and written.
- Excellent writing skills, ability to publish and promote your research
- Excellent communication, organisational skills and managerial ability for the project
- Proactive, creative, independent and highly-motivated candidate
- Interpersonal skills, problem-solving, initiative, rigor and teamwork abilities

Scientific environment:

The postdoctoral researcher will work within the **LMGP, Materials and Physical Engineering Laboratory** in Grenoble, in the *Nanoionics group* within the Nanomaterials and advanced nanostructures (NanoMAT) team. Located in the heart of an exceptional scientific environment, the LMGP offers the applicant a rewarding place to work.

LMGP Web Site: <http://www.lmgp.grenoble-inp.fr/>

In addition, the postdoctoral researcher will have a strong interaction and will collaborate with the two other groups within the French-German consortium, including Prof. Dr. Roger A. De Souza's group at RWTH Aachen and Prof. Regina Dittmann's group at FZ-Jülich.

Salary range:

Depending on experience, starting from 2480 € gross monthly

Application procedure:

Please send ASAP your motivation letter, CV, list of publications and contact details of two referees to:

monica.burriel@grenoble-inp.fr