Research Grants for PhD students from the China Scholarship Council

Information Form (please read the guidelines carefully on the website www-csc.utt.fr)

Supervisor's name : Gautier | Given names : Brice

Status (prof., assistant prof., …) : Professor

Laboratory : Institut des Nanotechnologies de Lyon CNRS UMR5270 ECL INSA UCBL CPE | Website address : https://inl.cnrs.fr/en/

Institution : INSA Lyon | Website address : https://www.insa-lyon.fr/en/

Scientific competence of the supervisor:

Nanoscale electrical measurements using atomic force microscopy. Research topics focused on the control of ferroelectrics domains in films and single crystals with the aim of understanding the switching and growth of ferroelectric domains, and electrical properties of domain walls. Participated to 7 ANR (including a French-German project) and 1 European project related to ferroelectric characterization. Member of the CNANO network, being the CNANO president of the nanometrology club (400 members, 30 % from industry) devoted to the measurement at the nanoscale. Co-author of more than 110 papers (international journals or peer-reviewed conferences)

Two major publications in the field proposed for the PhD :

1. M. A. Moreno Villavicencio, N. Chevalier, J.P. Barnes, B. Gautier. J. Vac . Sci. Technol. B, 2020, 38, doi : 10.1116/6.0000114
2. S. Martin, N. Baboux, D. Albertini, B. Gautier. Rev. Sci. Instr. 88, 023901 (2017), doi: 10.1063/1.4974953

Website address of the personal page :

Supervisor's email : brice.gautier@insa-lyon.fr

Description of the research work proposed for a PhD ***Topic # (see list) :*** IV-1, IV-2, IV-11

Title : Nanoscale conduction phenomena in new photoferroelectrics systems: from synthesis to devices

Subject :

The present PhD project aims to explore ferroelectric oxides as promising candidates with exciting photo(ferro)conductive properties in new nanoelectronic devices. Commonly described as wide bandgap semiconductors, ferroelectrics possess a remnant internal electric dipole called polarization. Recently, ferroelectric oxides were found to have larger than bandgap open circuit photovoltages. Further, the recent discoveries of other various photoconduction effects e.g. photostriction or photocatalysis and in different ferroelectrics have triggered an intense global effort in a disruptive materials paradigm, where multifunctional applications combine light with charge for their operation. This has led to these materials cast in entirely new “light”, termed as photoferroelectrics.
In this framework, this project aims at searching new materials and ways to combine them to control the band gap while retrieving the ferroelectric state. Investigations on the nanoconductive phenomena in classical ferroelectrics, still not fully understood, under equivalent conditions, will be needed to understand the conductive phenomena in these new materials, under different external stimuli, including light, to end up proposing new device concepts based in these photo(ferro)electric systems.

Keywords :

ferroelectrics, thin films technology, nanoscale electrical properties

Expected collaborations :

Within the lab: with Ingrid Cañero Infante (co-advisor, Electronic Devices team), Bertrand Vilquin (Materials team), Virginie Monnier (Surface Chemistry team), Pedro Rojo-Romeo (Nanophotonics team), Nicolas Baboux (Electronic Devices team); External collaborations: Jules Galipaud (LTDS UMR 5513); Matthieu Budget (MATEIS UMR 5510)

Background required from the applicant :

robust material science training (preferable in chemistry, or physics); skills for thin film characterization, technology and processing; scientific curiosity and easiness to work in team; large capabilities to read/write and communicate in English

Existence of a PDF file detailing the proposal ("yes" or "no") : yes

(see guidelines on the website www-csc.utt.fr)