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 : GOMES Given names : Séverine

Status (prof., assistant prof., …) : CNRS researcher

Laboratory :	Centre for Energy and Thermal Sciences of Lyon (CETHIL)	Website address : http://cethil.insa-lyon.fr
Institution :	National Institute for Applied Sciences (INSA), Lyon	Website address : http://www.insa-lyon.fr/en

Scientific competence of the supervisor:

The 'Micro and Nanoscale Heat Transfer' (MiNT) group at CETHIL consists usually of 15 members, including 5 permanent researchers. Among the main scientific interests: nanoscale energy control, in particular thermal management inside materials and sub-wavelength thermal radiation, nanothermodynamics and their applications in energy-harvesting devices, atomic force microscopy. The project will involve Dr Séverine GOMES and Dr P-Olivier CHAPUIS.

Two major publications in the field proposed for the PhD :

1. Radial dependence of thermal transport in silicon nanowires, M. Verdier, et al., Journal of Physics: Materials 2, 015002 (2019)
2. Native oxide limited cross-plane thermal transport in suspended silicon membranes revealed by scanning thermal microscopy, A.M. Massoud, et al., Applied Physics Letters 111, 063106 (2017)

Website address of the personal page : http://polivier.chapuis.free.fr

Supervisor's email : severine.gomes@insa-lyon.fr

Description of the research work proposed for a PhD ***Topic # (see list) :*** IV-1,IV-2,IV-6,V-4,

Title : Experimental investigation of heat transfer in nanomaterials: towards the ultimate 1D chains

Subject :

The control of heat transfer is key to many applications of the 21st century, especially if one wants to reduce the global energy consumption or at least limits its increase. In addition, heating is detrimental to nanoelectronics as device performances decrease when temperature increases. Unfortunately, the ultimate laws of heat transfer in the smallest materials possible, i.e. 1D atomic chains, have not been experimentally tested until now. It is known that Fourier's law of heat conduction is not anymore valid at nanoscale, due to the presence of interfaces and also to the change in the nature of heat conduction: it ceases to be diffusive, and becomes ballistic. In the current PhD project, nanoscale samples such as suspended thin sheets, nanowires and structures tending to 1D atomic chains will be characterized by scanning thermal microscopy (SThM), a technique based on atomic force microscopy where a sensitive thermometer sensor is added at the apex of the tip. CETHIL is one of the key labs in the world mastering such technique. The work will therefore be mostly experimental and involve advanced techniques allowing to measuring low power levels with nanometric spatial resolution.

Keywords :

Heat transfer, Nanostructure, Phonons, Wave, Atomic chains, Suspended nano-ribbons.

Expected collaborations :

Research groups working in the nanophononics and phonon enrgineering areas and the INL NanoLyon platform on the campus in Lyon. Usual work is performed in close collaborations with various groups around the world.

Background required from the applicant :

Heat conduction, Atomic force microscopy, Materials science

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

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