Séminaire du CETHIL

Mercredi 21/06/2017 à 13h30

Salle 022, bâtiment Carnot

From energy storage to thermal detectors by using Si-based micro and nanotechnology platforms

Auteur

Mika PRUNNILA, Research Team Leader, VTT Technical Research Centre of Finland Ltd, Espoo, Finland – Invited Professor at INSA (June 2017)

Abstract

We will start by discussing Si-based large-area nanostructures as potential candidates for energy storage applications. What comes to electric double-layer capacitor (supercapacitor) energy storages, chemical reactiveness typically prevents the direct utilization of Si. We will show that by adapting conformal coating of Si nanostructures a highly stable supercapacitors and proof-of-concept storage inside a silicon chip – the in-chip supercapacitor – can be realized [1]. Important property modified by nano-structuring is the thermal conductivity, tailoring of which is important for, for example, thermal detectors. Here, we will discuss an uncooled high sensitivity thermoelectric detectors based on suspended ultra-thin single-crystalline Si thermocouples [2] and estimate the fundamental detection limits posed by thermal fluctuation noise. Fluctuations can be reduced and performance enhanced by lowering the operation temperature. This brings in different physical phenomena and quantum effects become enhanced. At the end of the talk some of our recent work on low temperature thermal devices, such as, primary thermometers and on-chip coolers will be discussed [3].

[1] K. Grigoras *et al.*, Nano energy **26** 340 (2016).
[2] A. Timofeev *et al.*, arXiv:1704.02511 (2017).
[3] D. I. Bradley *et al.*, Nature comm. **7** 10455 (2016) & Sci. Rep. **7** 45566 (2017).

Short CV

Mika PRUNNILA is the leader of the Nanoelectronics group at VTT Technical Research Centre of Finland Ltd in Espoo, near Helsinki (Finland). He is active in fields involving nanoelectronic, microelectronic and quantum devices, ranging from design, theory, fabrication and characterization work to different applications. His topics include, for example, microcoolers, detectors, biosensors, MOSFETs, electronic and thermal transport in nanostructures, energy storage and energy harvesting. He got his PhD (2007) from Aalto University. He is author/co-author of more than 60 peer-reviewed journal papers.

Invité par :

Olivier CHAPUIS

Contact pour le séminaire du CETHIL : Mohamed AMARA et Abdelkrim TRABELSI