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CV/ biography

P.-Olivier Chapuis (Engineer & MS, 2004, and PhD, 2007, Ecole Centrale Paris) is a CNRS Research Scientist at CETHIL in the Microscale and Nanoscale Heat Transfer (MiNT) group since 2011. He was previously a post-doctoral researcher at the Catalan Institute of Nanotechnology (ICN2) in Barcelona (2008-2011). His interests deal with nanoscale heat transfer and conversion, in particular sub-wavelength thermal radiation and phonon heat conduction, including applications such as thermophotovoltaic energy harvesting or thermal management for electronics. His works involve both theoretical (Boltzmann transport equation, fluctuation electrodynamics) and experimental (scanning thermal microscopy, electro-thermal measurements) aspects.

SCANNING THERMAL MICROSCOPY: PROBING TEMPERATURE AND HEAT DISSIPATION DOWN TO THE FEW-NANOMETER SCALE

Scanning thermal microscopy (SThM) [1], a technique derived from atomic force microscopy aiming at characterizing energy transfer at nanoscale, is applied with different thermoresistive tips, providing down to 10 nm spatial, few mK temperature, and pW.K^{-1} thermal conductance resolutions. Two main applications are highlighted: nanoscale thermal transport property determination and thermometry.
In ambient conditions, we demonstrate ballistic thermal transport in air. In vacuum, the tip-sample exchange before contact is mediated by means of near-field thermal radiation [2] and then by heat conduction across constrictions. SThM is found to be applicable for characterizing materials with thermal conductivity lower than ~3 W.m^{-1}.K^{-1}, but reduced sample area, as in the case of suspended phononic nanomembranes, can allow characterizing thermal conductivity in air up to ~50 W.m^{-1}.K^{-1} [3]. Recent results obtained for various set of samples are underlined, including thin oxide amorphous films down to the native-oxide case [4]. Thermal transport mechanisms are discussed, in particular when ballistic phonon dissipation takes place.
We also highlight strategies for performing small-scale thermometry and discuss the link between the thermal signal and the actual sample temperature [5], taking examples from the electronics industry.

[1] S. Gomès et al., Phys. Stat. Sol. A 212, 477 (2015). [2] C. Lucchesi *et al*, submitted. ArXiV:1912.09394. [3] A.M. Massoud *et al*., Appl. Phys. Lett. 111, 063106 (2017). [4] E. Guen *et al.*, submitted. [5] A. Pic *et al.*, submitted.

This work was performed with E. Guen[1], A.M. Massoud[12], A. Pic[13], C. Lucchesi[1], V. Lacatena[4], M. Haras[4] (PhD students), A. Alkurdi[1] (post-doc), J.F. Robillard[4], J.M. Bluet[2], S. Gallois-Garreignot[3], R. Vaillon[15], S. Gomes[1] (colleagues). [1]CETHIL, [2]INL, [3]ST Micro, [4]IEMN, [5]IES.

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