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Thermometry at the nanoscale

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There is an increasing demand for accurate, non-invasive and self-reference temperature measurements as technology progresses into the nanoscale. This is particularly so in micro- and nanofluidics where the comprehension of heat transfer and thermal conductivity mechanisms can play a crucial role in areas as diverse as energy transfer and cell physiology. The integration of optics and micro/nanofluidic devices to provide novel functionalities in nanosystems is stimulating a promising new area of optofluidics, for nanomedicine and energy. Despite promising progress precision control of fluid temperature by accounting for local temperature gradients, heat propagation and accurate temperature distributions have not yet been satisfactorily addressed, e.g., investigating heat transfer mechanisms in nanofluids or mapping temperature distributions within living cells. The major obstacle for this has been the unavailability of a thermometer with the following requirements (that should be simultaneously satisfied): (i) high temperature resolution (<0.5 K); (ii) ratiometric temperature output; (iii) high spatial resolution (<3 μm); (iv) functional independency of changes in pH, ionic strength and surrounding biomacromolecules; and (v) concentration-independent output. The most suitable class of thermometers to fulfill these requirements is the luminescent ones. In this talk we will present a general overview on thermometry at the nanoscale highlighting the main achievements and limitations on luminescent based thermometers, focusing on the new results published recently about nanoplateforms integrated heaters and thermometers.

Biography

Carlos D S Brites graduated in Physics and Chemistry teaching (Universidade de Aveiro, Portugal), Master in Optoelectronics and Lasers (University of Oporto, Portugal) and completed his PhD in 2012 at CICECO/ Physics Department, University of Aveiro, Portugal and ICMA/ Physics of Condensed Matter Department, University of Zaragoza, Spain, working on "Self-Referencing Thermometry at the Nanoscale". He did his Post-Doctoral fellowship in CICECO/ Departamento de Física, Universidade de Aveiro, 2013. He has published more than 10 papers in reputed journals and serving as a regular reviewer of more than 15 journals.

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