Microscale Temperature and Molecular Concentration Mapping Using Quantitative Phase Imaging

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ABSTRACT:
Microscale thermophoresis is the motion of dissolved species (e.g., DNA, proteins, colloids) in a temperature gradient in sub-100µm dimension. In traditional thermophoresis, the diffusion coefficient of these dissolved species being very small makes the whole process very slow and inefficient to investigate. In micrometric dimension, this process is much faster to investigate but also complicated as one needs to investigate two microscale fields : temperature and solute concentration. It usually involves the use of fluorescent labels, but this approach is invasive and can give erroneous results.

We show that microscale temperature and concentration can be mapped using a quantitative phase microscopy technique named quadriwave lateral shearing interferometry (QLSI) [1]. Temperature and concentration gradients create variations in refractive index in the surrounding liquid medium and the distortion of an incoming optical wavefront in this medium can be quantitatively analyzed by QLSI (Figure 1). The strong benefit of this approach is that it is label-free. First results on metrology in microscale thermophoresis in liquids will be presented.

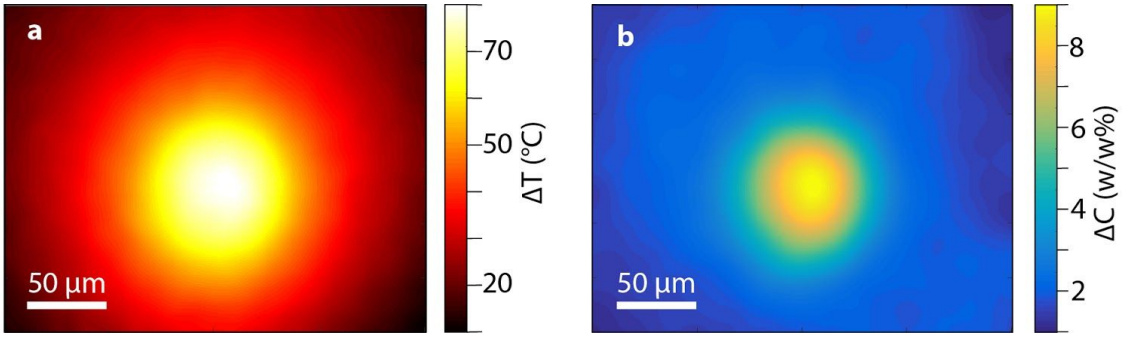

Figure 1: (a) Temperature gradient and (b) concentration gradient map at microscale.

REFERENCE:

[1] G. Baffou, P. Bon, J. Savatier, J. Polleux, M. Zhu, M. Merlin, H. Rigneault, and S. Monneret. "Thermal imaging of nanostructures by quantitative optical phase analysis." *ACS nano*, ***6*(3)**, 2452-2458 (2012).