Studying Sore effect using microfluidic cell

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Soert effect (thermophoresis or thermodiffusion) is transport of mass in a multicomponent system due to presence of a temperature gradient [1]. The effect nowdays finds many application in (bio)chemical analisys, separation of mixtures, biotechnology and semiconductor industry.

To study the effect one needs to create relatively high temperature gradients keeping the temperature difference at the same time relatively small to maintain the linearity of the system. We try to achive this by reducing the dimensions of the system. We developed a microfluidic cell which allows observing thermal diffusion in the solution of colloids and could be also applied for investigation of thermophoretic phenomena in biological systems such as lipid bilayers and living cells.

The developed cell consist of three channels (fig.1A): two relatively big ones for providing high flow rate of hot and cold liquid and a small channel in between them which contains the sample to study. The cell is produced by micromilling the Plexiglas block with a CNC machine. The central channel is made very flat (hight=30 um, width=100 um) to prevent convection. The produced cell is shown in fig.1B.

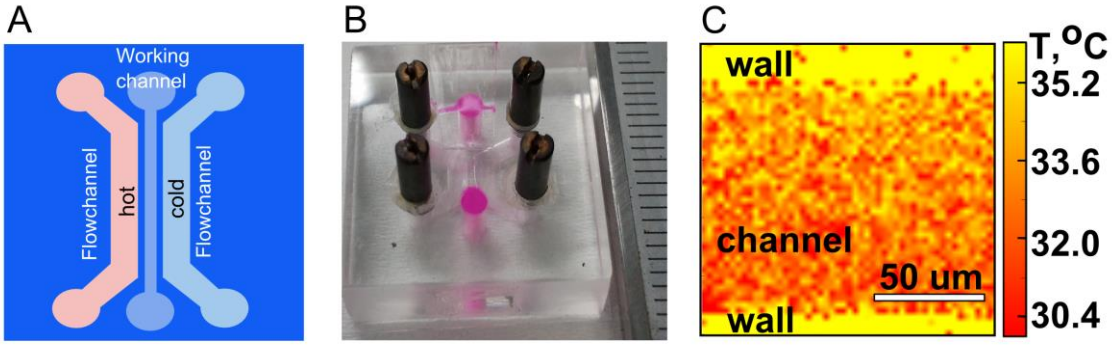

Figure 1. A:Schematics of the cell (not in scale), B: photograph of the completed cell, C: themperature distribution in the central channel obtained with FLIM.

To characterize the temperature distribution in our cell we used fluorescence life-time microscopy (FLIM) [2] with Rhodamine B as a temperature sensitive dye (fig.1C).

The cell was applied to investigate thermodiffusion of latex micro and nano beads in a size range from 25 nm to 1 mn in water. The Sore coefficient for all investigated particle sizes was defined from the equilibrium distribution. For nanobeads it was compared with the values obtained by TDFRS measurements.

References

[1] Piazza,R. and Parola,A, Thermophoresis in colloidal suspensions, J. Phys.: Condens. Matter, **20**, 153102 (2008)

[2] Chang,C., Sud,D. and Mycek,M., Fluorescence Lifetime Imaging Microscopy, Methods in cell biology, **81**, (2007)