Droplet in micro-channels:

a numerical approach using an adaptive two phase solver

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ABSTRACT

Droplet-based microfluidics is a very promising tool for performing biochemical or chemical assays. Droplets are unit systems of controlled volume and content, within which mixing can be easily achieved. Several physical phenomena (mechanics, thermocapillarity, solutocapillarity, thermomechanics) either in cumulative or compensative ways appears when. It is of prime importance to characterize, under controlled experimental conditions, within which range each contribution is the dominant phenomena regarding element migration. Rationalizing these various effects would have important consequences for lab-on-a-chips, and numerical studies are one of way to understand each contribution separately.

We propose a numerical approach of the mechanics of a flowing bubble in a constraint channel using a open source two phase solverg (Gerris, http://gfs.sourceforge.net) to understand the bubble dynamics (i.e. shape and terminal velocity) induced by the interaction between the bubble via the Laplace pressure variation and the lubrication film near the channel wall. Quantitative and qualitative results are presented and compared against both theory and experimental data for small Capillary numbers.

We discuss the technical issues of explicit codes on small Capillary numbers and the possibility to adding Van der Walls forces to give a more precise picture of the Droplet-based microfluidic problem.

REFERENCES

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