

Two phase flows of non-Newtonian liquids in microchannels

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Abstract

Two phase liquid-liquid flows in microfluidic devices have found several chemical engineering applications in, for example, mixing, separations and reactions. From the various patterns that can form, plug flow is particularly favoured because it offers increased mixing and large interfacial areas. However, most of the studies consider plug flow in Newtonian liquids with low viscosities while many fluids for industrial applications are likely to exhibit complex rheological behaviour.

The talk will present recent studies on the hydrodynamic characteristics and velocity fields of aqueous-organic two-phase flows in small channels. Xanthan gum solutions in water at different concentrations were used as the aqueous phase while the organic phase was a silicon oil. For the studies, two innovative micro Particle Image Velocimetry (μ PIV) techniques were developed, namely high speed bright field μ PIV, and two-colour μ PIV which allows the simultaneous capture of the velocity profiles in both phases. The results revealed a profound effect of the polymer on the flow pattern transitions in the small channels and on the geometric characteristics of the plug regime in particular. These changes will be discussed in relation to the shear rate and viscosity fields which develop in the non Newtonian aqueous phases.

Bio

Prof Panagiota Angeli specializes on complex multiphase flows and their application to process intensification in energy and manufacturing. She received her Diploma in Chemical Engineering from the National Technical University of Athens in 1990, and her PhD from Imperial College London in 1992. She joined the Department of Chemical Engineering at UCL in 1996.

Prof Angeli was guest editor of the Nuclear Process Engineering Special Issue in *ChERD* (2013) and was awarded a Leverhulme/RAEng Senior Research Fellowship in 2011. She participates in UK Research Council (EPSRC) and international (Norway, Sweden) research funding review panels, and was appointed Visiting Professor for Multiphase Flows in A* Institute of High Performance Computing, Singapore. Her work has been supported by EPSRC and European Union grants and industrial funding (Chevron, GSK, Xaar). She is co-Investigator in the EPSRC flagship project MEMPHIS on multiphase flows and is leading the EPSRC project CORAL on future formulation of complex products. Prof Angeli is currently co-chair of the Multiphase Flows Special Interest Group of the UK Fluids Network. She has published over 130 peer reviewed journal and conference papers.