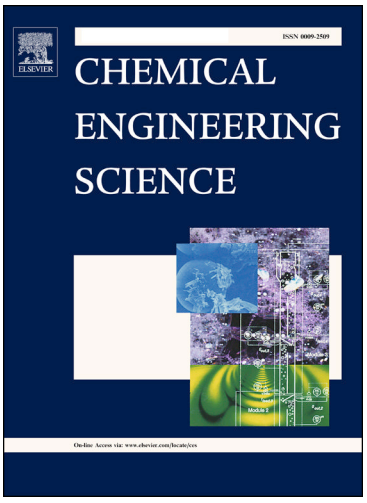

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Effect of surfactant on emulsification in microchannels.

Nina M. Kovalchuk*[a], Evangelia Roumpea[b], Emilia Nowak[a,1], Maxime Chinaud[b], Panagiota Angeli[b], Mark J.H. Simmons[a]

[a] School of Chemical Engineering, University of Birmingham, Edgbaston, Birmingham B15 2TT, UK

[b]Department of Chemical Engineering, University College London, Torrington Place, London WC1E 7JE, UK

Abstract

Drop formation in a microfluidic flow-focusing device (cross-junction) was studied in absence and presence of one of two ionic surfactants. Four different flow regimes: squeezing, dripping, jetting, and threading were observed in line with existing literature. The effect of surfactant on the transition between flow regimes was shown to depend upon the value of critical micelle concentration and correlates with dynamic surface tension. Drop length in the channel increased as the ratio of flow rate of dispersed to continuous phase, φ, increased. For drops smaller than the channel width, the increase was slow, proportional to $\varphi^{0.1}$, yet was much faster, proportional to φ, for larger drops. In contradiction to the expected stabilisation of drops by surfactant, surfactant-laden drops larger than the channel height coalesced inside the channel at a higher rate than surfactant-free drops. It is proposed that the coalescence is caused by the electrostatic attraction due to surfactant redistribution under the high shear stresses near the wall of the channel.

Key words: microfluidic drop formation, flow map, ionic surfactant, dynamic interfacial tension, critical micelle concentration, coalescence.

*Corresponding author: e-mail n.kovalchuk@bham.ac.uk

[1]Present address: Massey University, Auckland, 0745, New Zealand