Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

Flow behaviour and transitions in surfactant-laden gas-liquid vertical flows[1] IVAN ZADRAZIL, SOUROJEET CHAKRABORTY, OMAR MATAR, CHRISTOS MARKIDES, Imperial College London — The aim of this work is to elucidate the effect of surfactant additives on vertical gas-liquid counter-current pipe flows. Two experimental campaigns were undertaken, one with water and one with a light oil (Exxsol D80) as the liquid phase; in both cases air was used as the gaseous phase. Suitable surfactants were added to the liquid phase up to the critical micelle concentration (CMC); measurements in the absence of additives were also taken, for benchmarking. The experiments were performed in a 32-mm bore and 5-m long vertical pipe, over a range of superficial velocities (liquid: 1 to 7 m/s, gas: 1 to 44 m/s). High-speed axial- and side-view imaging was performed at different lengths along the pipe, together with pressure drop measurements. Flow regime maps were then obtained describing the observed flow behaviour and related phenomena, i.e., downwards/upwards annular flow, flooding, bridging, gas/liquid entrainment, oscillatory film flow, standing waves, climbing films, churn flow and dryout. Comparisons of the air-water and oil-water results will be presented and discussed, along with the role of the surfactants in affecting overall and detailed flow behaviour and transitions; in particular, a possible mechanism underlying the phenomenon of flooding will be presented.

[1]EPSRC UK Programme Grant EP/K003976/1

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Date submitted: 29 Jul 2016 Electronic form version 1.4