**Stability of an unsupported multi-layer surfactant laden liquid curtain under gravity**[1] DOMINIC HENRY, JAMAL UDDIN, University of Birmingham, UK, JEREMY MARSTON, Texas Tech University, USA, SIGURDUR THORODDSEN, King Abdullah University of Science and Technology, KSA — The industrial process of curtain coating has long been an important method in coating applications, by which a thin liquid curtain is formed to impinge upon a moving substrate, the highly lucrative advantage being able to coat multiple layers simultaneously. We investigate the linear stability of an unsupported two-layer liquid curtain, which has insoluble surfactants in both liquids. We formulate the governing equations, simplified by making a thin film approximation, from which we obtain equations describing the steady state profiles. We then examine the response of the curtain to small perturbations about this steady state to identify conditions under which the curtain is unstable, finding the addition of surfactants stabilizes the curtain. Our results are then compared to experimental data, showing a favourable trend and therefore extending the work of Brown[2] and Dyson *et al.*[3]

[2]D. Brown, *J. Fluid Mech.* **10**, 297-305 (1960).
[3]R.J. Dyson, J. Brander, C.J.W. Breward and P.D. Powell, *J. Eng. Math.* **64**, 237-250 (2009).

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