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Modelling two-phase slug self-propulsion in a capillary MATHIEU SELLIER, IRSHAD KHODABOCUS, VOLKER NOCK, University of Canterbury, CLAUDE VERDIER, CNRS — We present a numerical study of the flow of a droplet of two miscible fluids juxtaposed in a capillary tube. We show that the asymmetry of the system results in the spontaneous motion of the composite droplet which can be of potential use in microfluidics applications or for transport in porous media. We also show that the droplet motion is sustained until the miscible fluids have become fully mixed. The proposed numerical model is implemented in COMSOL Mutiphysics using the Laminar Two-Phase Flow Phase Field Method coupled with an advection-diffusion chemical concentration equation. The results are validated using experimental data from Reference 1 and explained in the context of a simplified phenomenological model. An important benefit of the simulation is the ability to investigate the transient behaviour composite droplet and the development of the internal flow features in the system which could allow the development of optimized systems.

[1] Bico, J., Quéré, D., Liquid trains in a tube, *Europhys. Lett.*, **51(5)**, 546 (2000)

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