Abstract Submitted
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Three-dimensional simulations of a rising bubble in a self-rewetting fluid[1] AMARNATH PREMLATA, MANOJ TRIPATHI, KIRTI SAHU, IIT Hyderabad, GEORGE KARAPETSAS, University of Thessaly, KHELLIL SEFIANE, University of Edinburgh, OMAR MATAR, Imperial College London — The motion of a gas bubble in a square channel with linearly increasing temperature in the vertical direction is investigated via 3D numerical simulations. The channel contains a so-called self-rewetting fluid whose surface tension exhibits a parabolic dependence on temperature with a well-defined minimum. An open-source finite-volume fluid flow solver, *Gerris*, is used with a dynamic adaptive grid refinement technique, based on the vorticity magnitude and position of the interface. We find that in self-rewetting fluids, the buoyancy-induced upward motion of the bubble is retarded by a thermocapillary-driven flow, which occurs as the bubble crosses the location at which the surface tension is minimum. The bubble then migrates downwards when thermocapillarity exceeds buoyancy. In its downward path, the bubble encounters regions of horizontal temperature gradients, which lead to bubble motion towards one of the channel walls. These phenomena are observed at sufficiently small Bond numbers and have no analogue for fluids whose surface tension decreases linearly with temperature. The mechanisms underlying these phenomena are elucidated by considering how the surface tension dependence on temperature affects the thermocapillary stresses in the flow.

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