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Counter-current thermocapillary migration of bubbles in self-rewetting liquids.[1] R. NAZARETH, University of Edinburgh, P. SAENZ, Massachusetts Institute of Technology, K. SEFIANE, University of Edinburgh, J. KIM, University of Maryland, P. VALLURI, University of Edinburgh — In this work, we study the counter-current thermocapillary propulsion of a suspended bubble in the fluid flowing inside a channel subject to an axial temperature gradient when the surface tension dependence on temperature is non-monotonic. We use direct numerical simulations to address the two-phase conservation of mass, momentum and energy with a volume-of-fluid method to resolve the deformable interface. Two distinct regimes of counter-current bubble migration are characterized: i) "exponential decay" where the bubble decelerates rapidly until it comes to a halt at the spatial position corresponding to the minimum surface tension and ii) "sustained oscillations" where the bubble oscillates about the point of minimum surface tension. We illustrate how these sustained oscillations arise at low capillary number O(10^{-5}) and moderate Reynolds number O(10) and, they are dampened by viscosity at lower Reynolds number. These results are in agreement with the experiments by Shanahan and Sefiane (Sci. Rep. 4, 2014).

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