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Counter-current thermocapillary migration of bubbles in self-rewetting liquids ROBSON NAZARETH, School of Engineering, The University of Edinburgh, PEDRO SÁENZ, Mathematics, MIT , GEORGE KARAPETSAS, School of Chemical Engineering, Aristotle University of Thessaloniki, KHELLIL SEFIANE, School of Engineering, The University of Edinburgh, OMAR MATAR, Department of Chemical Engineering, Imperial College London, PRASHANT VALLURI, School of Engineering, The University of Edinburgh — Thermocapillary migration of bubbles has been studied since Young described a bubble rising in a pure, quiescent liquid subject to a vertical temperature gradient. Pure liquids usually exhibit a linearly-decreasing dependence of surface tension on temperature. Here, we consider so-called 'self-rewetting' fluids where surface tension is a parabolic function of temperature with a defined minima. Specifically, we target the counter-current thermocapillary migration of a bubble under temperature gradient. We present DNS using the Basilisk solver to resolve the two-phase continuity, momentum, and energy equations with a VoF method to capture the interface. The simulations agree with the experimental and the theoretical findings of Shanahan and Sefiane (2014). Two distinct regimes are revealed: i) "steady migration" where the bubble migrates against flow to an equilibrium position at the surface tension minimum; and ii) "sustained oscillations" where the bubble undergoes steady oscillations around the equilibrium position after a transient migration period. We map these in Re and Ca number parameter space and explain sustained oscillations when Ca $<$O(10^{-4}) , and their damping in the range O(10^{-4}) $<$Ca $<$O(10^{-2}).

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