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Counter-current thermocapilllary migration of bubbles in microchannels using self-rewetting liquids ROBSON NAZARETH, The University of Edinburgh, PEDRO SAENZ, MIT, PRASHANT VALLURI, KHELLIL SEFIANE, The University of Edinburgh — The study of bubble transport in microchannels is of great interest in evaporative cooling of microdevices technologies. This is because bubble transport under heat-transfer or phase-change causes several flow instabilities that are less understood and hinder informed design of microcooling devices. Bubble motion in microchannels under temperature gradients is highly influenced by thermocapillary forces due surface tension gradients. Most studies until now so far are mainly based on pure liquids which present a linear temperature (inverse) dependence of surface tension. In this work, we consider motion of a bubble (formed of inert gas) in the so-called self-rewetting fluid that presents a parabolic (quadratic) dependence of surface tension on temperature, in a temperature range that includes a surface tension minimum. We particularly investigate the counter-current thermocapillary migration of bubbles in these liquids, as experimentally depicted by Shanahan and Sefiane (2014), by means of direct numerical simulations. We present a model that solves the 3D governing equations of mass, momentum, interface and energy for the two-phase system composed by incompressible, Newtonian and immiscible fluids. We resolve the deformable interface by means of a Volume-of-Fluid method. Our results indicate that there exists a pressure drop limit beyond which there would be no counter-current migration of bubbles.

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