Abstract Submitted
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Lattice Boltzmann simulation of self-driven bubble transport in a micro-channel with a virtual check valve[1] ROU CHEN, Indiana University-Purdue University Indianapolis, Indianpolis, IN, USA, WEI DIAO, YONGGUANG CHENG, School of Resources and Environmental Science, Wuhan University, Hubei, China, LIKUN ZHU, HUIDAN (WHITNEY) YU, Indiana University-Purdue University Indianapolis, Indianpolis, IN, USA — An innovative self-circulation, self-regulation mechanism has recently been proposed to experimentally generate gaseous species from liquid reactants with little or zero parasitic power consumption. When a bubble grows at a location close to a virtual check valve, expansion of the left meniscus of the bubble is hindered due to its capability to provide a higher capillary pressure than the right meniscus does. We perform numerical simulation of bubble transport in a channel with a virtual check valve using lattice Boltzmann method to provide benchmarks for the experiments. A stable discretized lattice Boltzmann equation is employed to simulate incompressible bubble-liquid flows with density ratio above 1000. Polynomial wall free energy boundary condition is introduced and examined for static cases with a bubble sitting on solid surfaces for a triple contact among bubble, liquid, and solid surface. In this work, we focus on the effects of channel ratio between with and without check valve on the dynamics of bubble-driven liquid circulation.

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