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Simulation of Ammonia-Water Two Phase Flow in Bubble Pump

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Abstract : The diffusion-absorption refrigeration cycle consists of a generator bubble pump, an absorber, an evaporator and a condenser, and usually operates with ammonia/water/ hydrogen or helium as the working fluid. The aim of this paper is to study the stability problem a bubble pump. In fact instability can caused a reduction of bubble pump efficiency. To achieve this goal, we have simulated the behaviour of two-phase flow in a bubble pump by using a drift flow model. Equations of a drift flow model are formulated in the transitional regime, non-adiabatic condition and thermodynamic equilibrium between the liquid and vapour phases. Equations resolution allowed to define void fraction, and liquid and vapour velocities, as well as pressure and mixing enthalpy. Ammonia-water mixing is used as working fluid, where ammonia mass fraction in the inlet is 0.6. Present simulation is conducted out for a heating flux of 2 kW/m² to 5 kW/m² and bubble pump tube length of 1 m and 2.5 mm of inner diameter. Simulation results reveal oscillations of vapour and liquid velocities along time. Oscillations decrease with time and with heat flux. For sufficient time the steady state is established, it is characterised by constant liquid velocity and void fraction values. However, vapour velocity does not have the same behaviour, it increases for steady state too. On the other hand, pressure drop oscillations are studied.

Keywords : bubble pump, drift flow model, instability, simulation
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