Desorption Of Water from Lithium Bromide Solution by Flow Boiling in Microchannels

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An experimental study of desorption of water (H_2O) from an aqueous salt solution of lithium bromide (LiBr) by flow boiling in a microchannel is presented. Gravity is used to separate water vapor at the exit of the microchannel. The objectives are to (a) study the feasibility of desorption, and (b) perform global measurements to quantify the desorption rate as a function of heat flux, inlet solution concentration and channel diameter.

Desorption using two single circular microtubes of diameter 125 um and 250 um were studied for an inlet solution volumetric flow rate of 0.46 ml/min. Inlet solution concentration was varied from 47.0 to 57.5 percent by mass of LiBr while the microchannel heat flux was varied from 18.6 W/cm^2 to 30.6 W/cm^2. Global measurements of pressure difference across the microtube, inlet solution temperature and concentration, and inlet and exit mass flow rates were recorded. Experiments were performed with the microtube exit open to a separation chamber at ambient atmosphere.

Results from the single channel experiments indicate that desorption rate increases with increase in heat flux and with reduction in inlet solution concentration. Pressure differential between the channel inlet and exit indicates flow boiling in the plenum for low inlet solution concentration. Flow visualization studies indicate different regimes of the solution flow at the channel exit for varying flow rates, heat fluxes, and inlet solution concentrations. Preliminary test results with a 10-channel desorber are also presented. Based on desorption rate estimates from single channel experiments, a design for a parallel channel desorber array capable of providing 4 g/min of H_2O for a 150 W heat pump is presented.