Abstract Submitted
for the DFD06 Meeting of
The American Physical Society

Bubbly flow in a low pressure evaporator and condenser[1] SIMO MAKIHARJU, WILLIAM SCHULTZ, HERMAN MERTE, University of Michigan
— The use of bubbles in a low pressure evaporator and condenser is examined theoretically, experimentally and with simplified computations. A desalination apparatus operating over small temperature differences, approximately 10K, to use waste heat is the motivation for the research. Because of the very small temperature differences and the desire to have compact equipment, use of direct contact condensation or evaporation using bubbles or drops is advantageous. The practical aim is to obtain a simple numerical model to be used in an optimization scheme and hence the model has to be fast to execute. For this reason the heat transfer between the liquid and the dispersed vapor bubbles was to be modeled using simplified correlations. The very low apparatus pressure, 3 to 14 kPa, pressed the need for experimentation as well. Noncondensable gases will be present a further complication. In most of the preliminary research we chose to neglect the effect of these gases, however they will be considered progressively more and the practical requirement is to at least obtain a qualitative correlation counting for their effects. No correlation in the existing literature was found to be valid in the parameter range encountered in the device. Bubbles grow or shrink considerably as a consequence of phase change and the large hydrostatic pressure differences.

[1]Research supported by the LEV group

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Date submitted: 04 Aug 2006 Electronic form version 1.4