2017 年度研究活動報告

Research activities in 2017

機械科学・航空学科　齋藤　潔

Kiyoshi Saito, Dept. of Applied Mechanics and Aerospace Engineering,

論文

Published papers

1) *Analytical solution of film mass-transfer on a partially wetted absorber tube,* International Journal of Thermal Sciences, Vol. 118, (2017), pp.176-186, N. Giannetti, A. Rocchetti, S. Yamaguchi, K. Saito.

2) *Experimental performance of a double-lift absorption heat transformer for manufacturing-process steam generation,* Energy Conversion and Management, Vol. 148, (2017), pp.267-278, A. Lubis, N. Giannetti, S. Yamaguchi, K. Saito, N. Inoue.

3) *Cascade refrigeration system with inverse Brayton cycle on the cold side,* Applied Thermal Engineering, Vol. 127, (2017), pp.986-995, N. Giannetti, A. Milazzo, A. Rocchetti, K. Saito.

学会発表

Presentations in conferences

1) *フィンチューブ接触器における流下液膜の濡れ性の解明(Wetting Characteristics of falling films on a fin-tube contactor),* 2017 年度日本冷凍空調学会 年次大会, September 26th -29th, (2017), *乾　はなこ*, ジャンネッティ ニコロ, 山口 誠一, 齋藤 潔.

2) *Annual Performance Evaluation of Refrigerated Display Cabinets,* 2017 年度日本冷凍空調学会 年次大会, September 26th -29th, (2017), M.A. Redo, N. Giannetti, K. Ohno, S. Yamaguchi, K. Saito.

3) *Two-phase Flow Distribution at Wider Flow Range within the Vertical Header of Microchannel Heat Exchanger,* 2017 年度日本冷凍空調学会 年次大会, September 26th -29th, (2017), M.A. Redo, N. Giannetti, J. Jeong, K. Enoki, I. Ota, S. Yamaguchi, K. Saito, H. Kim.

4) *Numerical simulation of Marangoni convection within horizontal tube falling film absorbers,* 28th International Symposium on Transport Phenomena, September 22th - 24th, (2017), *University of Peradeniya, Sri Lanka,* N. Giannetti, S. Yamaguchi, K. Saito.

5) *Simplified expressions of the transfer coefficients on a partially wet absorber tube,* International Sorption Heat Pump Conference (ISHPC2017), August 7th – 10th, (2017), Tokyo, Japan, N. Giannetti, S. Yamaguchi, K. Saito.

6) *Numerical simulation of Marangoni convection within absorptive aqueous Li-Br,* International Sorption Heat Pump Conference (ISHPC2017), August 7th – 10th, (2017), Tokyo, Japan, N. Giannetti, S. Yamaguchi, K. Saito.

7) *Thermodynamic modelling of humid-air expansion within an R717/R729 cascade refrigeration system for cold store applications,* 5th IIR International Conference on Thermophysical Properties and Transfer Processes of Refrigerants (TPTPR2017), APRIL 23rd – 26th, (2017), Seoul, South Korea, N. Giannetti, A. Milazzo, A. Rocchetti, K. Saito.

8) *マイクロチャンネル垂直ヘッダーにおける R410A の二相流分配特性(Two-phase flow distribution of R410A within the vertical header of a microchannel heat exchanger),* 第 27 回 環境工学総合シンポジウム 2017, July 10th – 12th, (2017), 静岡県浜松市, Japan, レド マーク, ジャンネッティ ニコロ, 鄭 宗秀, 榎木 光治, 太田 育秀, 齋藤 潔, 金 鉉永.

9) *Derivation and Validation of Dimensionless Models for the Heat and Mass Transfer Coefficients of a Structured Packed Bed Dehumidifier,* 2nd International Conference on Energy and Indoor Environment for Hot Climates, February 26th – 27th, (2017), Doha, Qatar, R.J. Varela, S. Yamaguchi, N. Giannetti, K. Saito, M. Harada, H. Miyauchi.

研究成果

ヒートポンプの実負荷環境を考慮した高効率制御を目指し，2017 年度は，気液二相流の相分離現象の解明とその一般的理論式の導出を行った．気液二相流の相分離および分配は，ヒートポンプの性能を決定する非常に重要な要因の一つである．具体的には，比較的単純な T 字分岐管を対象に，その分流・相分離特性を，圧力損失による散逸エネルギーが最小になるとの仮定の下で，解析的に導出した．この解析解を実験結果と比較したところ，良好な一致が見られその妥当氏が確認された．また，この解析解は非常に複雑な数式となっていることから，設計者にとって利用できる形に単純化を行い，気液二相流の分流・相分離を簡易に予測できる相関式を作成することができた．

Research achievement

In 2017, we tried to derive a theoretical formulation regarding the phase separation phenomenon of gas-liquid two phase flow in an impact type T-shape junction tube. The phenomenon strongly affects the dynamic performance of a heat pump system, which is one of the promising technology for energy saving in various fields. The theoretical formulation has been derived from the assumption that the dissipation of energy caused by the tube friction is minimum in a steady-flow configuration, namely applying Prigogine's theorem. As a result, the derived theoretical solution was validated by comparison with experimental data.