

Technical University of Denmark



Experimental and numerical analysis of brazed plate heat exchangers for organic fluids

Bennov, Lars; Wronski, Jorrit; Markussen, Wiebke Brix; Haglind, Fredrik

Publication date:
2013

[Link back to DTU Orbit](#)

Citation (APA):

Bennov, L., Wronski, J., Markussen, W. B., & Haglind, F. (2013). Experimental and numerical analysis of brazed plate heat exchangers for organic fluids. Poster session presented at ASME ORC 2nd International Seminar on ORC Power Systems, Rotterdam, Netherlands.

DTU Library

Technical Information Center of Denmark

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

EXPERIMENTAL AND NUMERICAL ANALYSIS OF BRAZED PLATE HEAT EXCHANGERS FOR ORGANIC FLUIDS

Lars Bennov*, Jorrit Wronski, Wiebke Brix Markussen, Fredrik Haglund

Technical University of Denmark
DTU Mechanical Engineering, Nils Koppels Allé 403, 2800 Kgs. Lyngby, Denmark
e-mail: jowr@mek.dtu.dk
web page: www.tes.mek.dtu.dk

ABSTRACT

n-Pentane is a suitable working fluid for ORC applications exploiting temperatures around 180 °C. This work investigates the heat transfer process in brazed plate heat exchangers (BPHE) for n-Pentane. It provides more accurate information regarding the boiling process, which is not much discussed in literature, yet. According to Roser et al. [4], two-phase heat transfer is significantly influenced by mass velocity and is therefore dominated by convective boiling. Whereas Dário et al. [1] conclude that nucleate boiling dominates due to a strong heat flux dependency.

We present a preliminary experimental analysis carried out with a test rig consisting of a plate-type preheater and evaporator as well as an expansion valve, a condenser and a pump. First tests were made with a maximum temperature and pressure of 145 °C and 5 bar, respectively, with a mass flow of approximately 0.05 kg s⁻¹. A numerical model is developed to compare experimental results with established heat transfer and pressure drop correlations from literature. Based on experimental and modelling results, the influence of nucleate and convective boiling is identified alongside other important parameters. Correlation from Focke et al. [2] correlates the experimental single-phase heat transfer coefficient, whereas correlation from Khan et al. [3] correlates the two-phase data. New correlations for single- and two-phase heat transfer of n-Pentane in BPHE, suitable for small-scale ORC, are developed from existing correlations. The molecular structural similarity of alkanes suggests that results can also be relevant for other alkanes, which yet is to be proven.

REFERENCES

- [1] E. R. Dário, G. G. Júnior, and J. C. Passos. Convective boiling heat transfer of the n-pentane inside an annular microchannel. In *Proceedings of ECI International Conference on Boiling Heat Transfer*, 2009.
- [2] W. W. Focke, J. Zachariades, and I. Olivier. The effect of the corrugation inclination angle on the thermohydraulic performance of plate heat exchangers. *Int. J. Heat Mass Transfer*, 28:1469–1479, 1985.
- [3] T. S. Khan, M. S. Khan, M.-C. Chyu, and Z. H. Ayub. Experimental investigation of evaporation heat transfer and pressure drop of ammonia in 60 degree chevron plate heat exchanger. *International Journal of Refrigeration*, 35:336–348, 2012.
- [4] R. Roser, B. Thonon, and P. Mercier. Experimental investigations on boiling of n-pentane across a horizontal tube bundle: two-phase flow and heat transfer characteristics. *International Journal of Refrigeration*, 22(7):536–547, 1999.