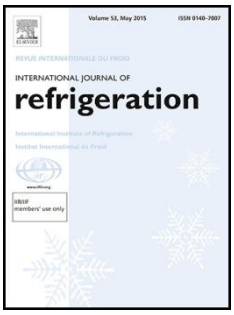
Accepted Manuscript



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PII: S0140-7007(17)30047-6
DOI: http://dx.doi.org/doi: 10.1016/j.ijrefrig.2017.01.027
Reference: JIJR 3539

To appear in: *International Journal of Refrigeration*

Received date: 15-9-2016
Revised date: 19-1-2017
Accepted date: 25-1-2017

Please cite this article as: Valerius Venzik, Dennis Roskosch, Burak Atakan, Propene/isobutane mixtures in heat pumps: an experimental investigation, *International Journal of Refrigeration* (2017), http://dx.doi.org/doi: 10.1016/j.ijrefrig.2017.01.027.

Propene/isobutane mixtures in heat pumps: an experimental investigation

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Highlights

- Experimental investigations of the influence of fluid mixtures on the overall process
- Pressure drop: negative influence on the temperature glide of a binary mixture
- Temperature glide: positive influence on the exergy losses within the heat exchangers
- Comparison of theoretical predicted and measured COPs

Abstract

Zeotropic mixtures in heat pumps, based on thermodynamic analysis, should lead to higher coefficients of performance (COP) due to the temperature glide which decreases exergy losses in the heat exchangers. However, fluid mixtures influence every component of a plant and the total system performance. In addition to the various theoretical studies in this field, a laboratory scale vapor compression heat pump test rig was designed and set up. In the present experimental investigations, the operating performance for the pure fluids isobutane and propene, and their mixtures are systematically investigated. COPs and exergetic efficiencies as a function of evaporation temperature, compressor speed and composition of the mixture are presented and compared with a theoretical approach. Contrary to theoretical expectations, the experimental results show only a slight increase of the COP for the mixture, compared to the better pure fluid, because heat exchanger pressure drops reduce the temperature glide.

Keywords:

vapor compression system, heat pumps, refrigeration mixture, hydrocarbon, temperature glide

1. Introduction

Today, fluids for thermodynamic cycles like vapour compression heat pumps or ORCs (organic rankine cycles) are commonly HFCs (hydrofluorocarbons) and in some cases the earlier fluids of the substance groups CFCs (chlorofluorocarbons) or HCFCs (hydrochlorofluorocarbons) are still used. Regarding ecological