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DEVELOPMENT OF INNOVATIVE PLATE HEAT EXCHANGERS FOR REFRIGERATION APPLICATION

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TECHNICAL SESSION TOPICS

3. New fluids and energy efficient transfer processes in advanced refrigeration technologies.

ABSTRACT

Plate heat exchangers (PHE) are commonly used for single-phase heat transfer from liquid to liquid finding extensive application in pharmaceutical industry, chemical processing and food treatment. In the last ten years they are also used for two-phase heat transfer, particularly as evaporators and condensers in chillers and heat pumps. The application to high pressure refrigerant fluids required the development of a new type of PHE, the brazed plate heat exchangers (BPHE) in which the different plates are brazed and not linked by gaskets. Although ensuring a great mechanical resistance, this solution doesn't allow the application of micro-finned surfaces, which are particularly effective in two-phase heat transfer with refrigerant, as the enhanced surfaces would be filled by the soldering material. Therefore the BPHE commercially available at this moment present plane heat transfer surface with traditional macro-scale corrugations (washboard, chevron, etc.) suitable only for single-phase heat transfer and not specifically developed for two-phase application. New soldering techniques, as laser, for example, allow to apply enhanced surfaces on the refrigerant side to increase condensation and evaporation heat transfer.
This paper presents the experimental work carried out to integrate the enhanced surfaces developed for intube refrigerant condensation and evaporation, such as micro-finned and cross-grooved, into plate heat exchangers. The enhanced surfaces are experimentally evaluated both in evaporation and condensation tests with refrigerant R22 and R407C and compared against commercial BPHE surfaces. The different surfaces are evaluated considering their specific heat capacity defined as the ratio between the heat flow rate exchanged and the nominal projected area of the effective plates. The enhanced surfaces investigated give an increase in specific heat capacity up to 50% with respect to common commercial BPHE surfaces, particularly in evaporation tests.

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