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ABSTRACT

"Modeling of refrigerants condensation in vertical pipe minichannel"

This doctoral dissertation deals with issues of heat exchange and flow resistance during refrigerants condensation in pipe minichannels. Research works concern the area of pro-ecological refrigerants condensation in the vertical channel, in air cooling conditions.

The desirability of research undertaken as part of the dissertation is justified by a small number of works regarding this topic. Experimental research was carried out to determine the parameters of the condensing process of refrigerants in single minichannels. The currently available, most commonly used pro-ecological refrigerants proposed as substitutes for endured freons, i.e. R404A, R407C and R410A, were used for this research. The research aimed to determine the main aspect of condensation process during flow and to develop dependencies that allow calculation of local and average values of heat transfer coefficient and flow resistance during condensation of refrigerants.

The first chapter is an introduction to the issues described in this work. This chapter draws attention to current trends regarding the construction of heat exchangers. It also indicates the directions of research on the refrigeration condensation process.

The second chapter of the work is devoted to the description of the current state of knowledge described in national and world publications. The author of the work analyzes the mechanism of condensation in channels with small diameters. There is also a comprehensive description of available and commonly used refrigerants and selected problems of classification of channels used for the construction of heat exchangers. The chapter contains a comprehensive comparison of researchers achievements in the field of heat exchange and pressure drop modeling.

In the third chapter, the author presents the description of experimental facility, the genesis and purpose of the dissertation, research hypotheses and the scope of research.

The fourth chapter contains a description of experimental research, including the aim and scope of research, a description of the measurement stand and detailed research methodology.

The fifth chapter contains the results of experimental tests of three refrigerants condensation in a vertical mini-pipe with an internal diameter d_w = 0,5 ÷ 2,5 mm. The results of the research were compared with the results of calculations according to the dependence of many authors. Attention was drawn to the significant problem of the relationship between the test results and identification of two-phase flow regimes.

The sixth chapter is devoted to the development of own empirical correlations describing heat exchange and pressure drop in air-cooled vertical minichannels. This chapter analyzes the impact of heat flux density on the heat exchange process. Hereby a universal model is presented that can be used for heat transfer coefficient values prediction in air and water cooling conditions.

The results of the research are summarized in the seventh chapter. The last chapter contains conclusions that meet the cognitive and applicational objective of the work.

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