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ACTUAL PROBLEMS OF RENEWABLE POWER ENGINEERING, CONSTRUCTION AND ENVIRONMENTAL ENGINEERING

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Participation without presentation

ANALYSIS OF ACCURACY DESCRIPTION PROPERTIES OF SUBSTANCES

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There has been accumulated a sufficient quantity of the material on the topic of the thermophysical properties of pure refrigerants. The analysis of the existing methods to determine the thermodynamic properties (TP) of mixtures of substances shows that they have no predictive capabilities. Therefore, in practice, either one or another model approach of describing the thermodynamic behavior of mixtures is used, refined on the basis of experimental data.

These include the unified equations of state, which are single-structural forms that allow reproducing TP with a given small error, both liquid and gaseous mixtures. For a multicomponent system, the equations of state (ES) is a thermodynamic model of the equilibrium vapor and liquid phases separately.

It is known that using ES, one can reveal the dependence of thermodynamic functions on υ and P, integrate differential thermodynamic relations, calculate the volatility (fugacity) of system components, through which phase equilibrium conditions are usually written. In addition, it is possible to establish a connection between the equations of state and any of the thermodynamic potentials of the system, expressed as a function of its natural variables.

The use of these equations for describing the state of matter at high densities is associated with the complexity of determining higher-order virial coefficients. In this regard, there have recently been created the empirical equations of state in which pressure is presented as a polynomial in density with coefficients depending on temperature. These equations also contain an exponential term introduced to compensate for higher-order terms of the virial equation.

To conduct a comparative analysis of various forms of ES, in order to identify their capabilities in describing the thermodynamic surface of binary zeotropic mixtures of refrigerants, three widely used ES were selected and the results of TP calculation were compared according to the original version of the Peng-Robinson (PR) [1], modified by Lee-Kesler (LK) [2] and the Helmholtz free energy equation (HFE) [3] with optimal cross parameters.

The fundamental impossibility of a simultaneous accurate description of the critical point parameters of individual substances and mixtures based on them did not allow accurate reproduction of the experimental data by cubic ES PR. On the whole, the ES PR compared with multiconstant ES showed a fairly acceptable accuracy for engineering calculations.

A comparative analysis of various forms of ES was carried out using experimental data on the boiling pressure and density of binary zeotropic mixtures of refrigerants. At the same time, to find the cross-section coefficients of the ES LK and HFE, we took into account the entire array of experimental data obtained both in this work and the data of other authors, taking into account the errors of the measured values.

The comparison showed that the experimental values of the boiling pressure of binary zeotropic mixtures of refrigerants are quite adequately consistent with the data published by a number of authors. This allowed us to rely on these results with confidence.

A detailed comparison of the three ES forms in describing the boiling pressure of the ternary mixture, R401A refrigerant, showed that the cubic ES PR using limited information and without taking into account the interaction of the mixture components (θij = 1) is in satisfactory agreement with experimental data.

In some cases, the multiconstant state of the ES LK is superior in accuracy to the state of HFE for binary mixtures of refrigerants, but in general it is inferior to it when describing the thermodynamic surface of a multicomponent mixture.

The model for the description of TP of substances of multicomponent mixtures of refrigerants, based on the corrected parameters of the ES HFE, gives an opportunity for more realistic description of the available experimental data, compared with other methods based on the rules for combining ES constants.

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EXPERIMENTAL RESEARCH OF THE DRYING GRAIN MATERIALS AT VARIOUS HEAT SUPPLY

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The work was carried out with the aim of establishing a rational method of supplying heat including a combination of microwave heating.

The experiments were conducted with a dense layer of oats at a fixed initial moisture content on the experimental setup, which provides research with microwave, microwave-convective and convective drying.

Research of the drying kinetics were conducted on the following modes: pulsed and continuous microwave energy supply, microwave-convective supply, cyclic and continuous, and convection.

In pulsed mode the microwave supply periods alternating with pauses.

We research the effect of the power-on time of the magnetron τ_{MW} and pauses τ_p on the regularities of changes in temperature and moisture content of the material, drying speed and specific energy consumption.

In the experiments to measure the power of the magnetron, the initial and final masses (m_0, m_f) and temperature (t_0, t_f), the duration and number of inclusions magnetron (τ_{MW}, n_{MW}) and pauses (τ_p, n_p).