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NUMERICAL INVESTIGATION OF HEAT PROCESSES IN LOW TEMPERATURE BATTERIES HEAT DURING PHASE TRANSFORMATIONS ACCUMULATING MATERIAL

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Modeling the process of heat and mass transfer is executed with the use of programcomplex the COMSOL Multiphysics 3.5a. As a result of numerical calculation the temperature fields are got in the system a pipe bunch and heat-accumulating material. The dynamics of accumulation process of thermal energy in the investigated object is studied.

Heat accumulator, accumulating material, heat exchange processes, phase transition.

The analysis of various sources [1-3], found insufficient information on the use of new methods of numerical modeling of transient physical processes that occur during phase transformations accumulating material. For the most part, to describe them using engineering methodology based on semi-empirical equations similarities and integrated methods, but they are not able to fully describe the character of a physical process in close to real. In many cases this leads to incorrect results.

The above gives the right to consider the use of computer technology, implemented in specialized computer software packages, the direction of experimental and modeling studies in order to understand the physical mechanism of phase transition processes in accumulating material when used as a working environment in accumulative devices. The proposed solution allows to calculate with reasonable accuracy for practice and heat and mass transfer, hydrodynamic

processes in stationary and transient conditions of the equipment in conditions close to real.

The purpose of research - computer programs for numerical research of processes of phase transition in heat accumulating materials of organic origin.

Materials and methods of research. When modeling processes of heat transfer element used battery environment program complex COMSOL Multiphysics 3.5a. Description of studied processes of heat and mass transfer in apparatus, enforced through: Navier - Stokes law and Fourier heat equation, if the phase transition. Navigating the interface is described by appropriate equations of continuity, momentum conservation, energy, mass and heat transfer equations addition, thermal conductivity, heat transfer and boundary and initial conditions.

Results of research. As a result of numerical simulation of heat and mass transfer processes in the bulk material was accumulating the influence of free convection on the intensity of heat transfer at the phase transition from the solid matter in the liquid state. Specifically established that the contribution of convective flow in the overall picture of the melting accumulating material around a cylindrical heat source with a smooth surface, increases the efficiency of the process and the rate of melting of the material placed over the source of heat. In addition, an analysis [4] and the results of numerical investigation of effectiveness of the design of the battery heat phase transition leads to the following assumptions: to better warm-accumulating material of lower levels, placing first row of heating tubes, from the bottom and walls of the housing battery should be done at a distance which does not exceed the limit radius R, distributing heat accumulating in the bulk material.

Conclusions

As a result of numerical simulation and analysis of the studied heat and mass transfer processes in the bulk accumulating material that changes its physical state, received distributions of temperature fields and the direction of heat flow in volume accumulating material and found that:

- the presence of convective heat flow increases the efficiency of heat transfer speed melting material placed over the heat source;

- the existence of dead zones in the lower corner of the accumulating volume of material made it possible to achieve the optimal deployment of elements of heat exchange surface in the battery case;

- to better heating material accumulating lower levels, placing first row of heating tubes in the heat accumulator advisable to carry out from the bottom and walls of the housing at a distance not exceeding R.

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