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Fine Dispersion and Intensification of Heat Transfer at Boiling in Electric Field on the Modified Surfaces

Ion Chernica, Mircea Bologa

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Abstract

The research tasks were formulated on the basis of scientific and applied aspects of engineering thermophysics and bioengineering. In the first part of the work the results of experimental study of heat transfer at boiling of a dielectric liquid in electric field on the modified surfaces are presented The surfaces are received using the electric spark alloying. The experimental conditions and the results of investigation of the influence of field strength, interelectrode distance and the specifics of heat supply are described. The maximum influence of the field is observed for an underdeveloped boiling regime, where the relative heat transfer coefficient increases with increasing of field strength and decreases with increasing of heat flux density. The optimal interelectrode distance is determined, at which the effects of heat transfer intensification under the influence of the field are most pronounced. The heat exchange has been intensified up to 6 times, compared with boiling in the absence of a field. In the area of developed bubble boiling, the field effect weakens and, depending on the experimental conditions, may even become negative. The influence of the electric field on the hydrodynamics of the vaporization process is discussed. In the second part of the work, on the basis of visual observations and high-speed filming, the features of generating of steam bubbles and the mechanism of microdispersion of a dielectric liquid under the influence of an electric field are analyzed. The regime parameters have been established at which the splitting of steam jets, the formation of a cloud of finely dispersed charged bubbles, and the behavior of micro– and nanofilms on the heat exchange surface are observed. The importance of determining of the number of vaporization centers, tear-off diameters and the frequency of bubble separation, the possibility of using microbial bio-coatings for the degree of cooling and

thermostating under controlled exposure to an electric field is emphasized. The obtained results can be used in calculations of the intensity of electroconvective heat exchange during boiling of weakly conducting heat carriers.

Keywords: heat transfer, boiling, thin dispersion, microfilms, nanofilms, heat flux, temperature head, electric fields

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