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SCIENTIFIC METHOD OF CREATION CAPILLARY-POROUS COOLING SYSTEMS FOR ELEMENTS OF ENERGY BUILDING OF POWER STATIONS

Abstract. To create a scientific methodology, studies of the ultimate heat fluxes in metallic and poorly heat-conducting porous structures operating under the combined action of gravitational and capillary forces and cooling various devices of thermal power plants have been carried out. On the basis of the problem of thermoelasticity and experimental data, the mechanism of destruction of metal vaporising surfaces and poorly heat-conducting coatings of low porosity made of natural mineral media (granite) is described. On the basis of the analogy of the phenomena, the dependences of the heat fluxes on the time of their action and the depth of penetration of temperature perturbations are revealed. Capillary - porous systems have high intensity, high heat transfer ability, reliability, compactness.
Keywords: heat transfer crisis; capillary-porous structure; heat and power installations.

INTRODUCTION. Successful use of capillary-porous materials in engineering attracted many researchers and inventors to create different devices on their basis. The intensity of heat-eliminating systems and the forcing of processes taking place therein increased [1-3]. In addition to cooling systems, the use of porous materials allowed the creation of units which addressed the problems of explosion safety, labor protection and durability [4,6]. This was facilitated by the ability to control evaporation processes due to excess fluid in pores and capillary structures, formed by the combined action of capillary and mass forces [7-9].

In thermal power plants (TPPs), capillary-porous materials are used to cool highly-forced detonation burner units [3], to create steam coolers in steam boilers [9], oil coolers that prevent oil from entering cooling water and water from entering the bearing system [10] and labyrinth seals [11], and are used in other devices [10]. The main areas of practical application of capillary-porous systems are presented in [3,5,8-11]. Equipment and technological processes in the energy sector should be introduced from the ecological and economic positions primarily. The proposed development of capillary-porous systems will facilitate the implementation of processes, significantly improving and preserving the natural environment.

The main advantages of capillary-porous systems include high intensity, high heat transportability, reliability, compactness, simplicity in manufacture and operation. These systems improve operational and technological performance and have low capital and operating costs. Based on the study of capillary-porous systems, new technical solutions have been developed to improve the performance characteristics of the thermal power plant in relation to the powerful power units of combined heat and power plants.

The authors of [12] carry out a comparative analysis of methods for calculating the heat transfer, based on the water boiling with underheating in vertical channels, and they consider that the hot spot corrosion of fuel element claddings of nuclear reactor fuel elements is similar to the capillary-porous structure [13,14]. However, no studies of heat transfer through a regular structured surface have been carried out.