SPECIALTY OF THE THERMAL STATE OF MICROJET BURNERS WITH THERMO-BARRIER COATINGS

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Objective. Establishment of the dependence of the thermal state of the flame stabilizer walls on the spatial localization of the thermal barrier coating on their outer surface based on CFD modeling.

Results. The study included the temperature regimes of microjet burner devices with flat flame stabilizers when applying thermal barrier coatings on various parts of their outer surface. Computer modeling was carried out for such variants of spatial localization of coatings: option a), corresponding to the coating of a part of the stabilizer surface, including a niche cavity (zone I), a side surface between the niche and the end surface (zone II) and an end surface of the stabilizer (zone III); option b), in which the coating was applied to the zones of surfaces II and III; and option c), in which the coating was localized only in zone III. In addition, option d) was considered, corresponding to the absence of a protective coating. For all the above options, the study of the thermal state of flame stabilizers was performed in a wide range of load variation of the boiler.

The results of numerical studies showed that at nominal values of the load of the boiler unit, the temperature of the outer surface of the flame stabilizer does not exceed the permissible value of 550 °C for all variants of spatial localization of the coating. However, at low loads of the boiler unit (20% of the nominal) for option c), the specified permissible wall temperature is exceeded. This is explained by the fact that in this case the cooling conditions are not favorable due to the low costs of the cooling agent (gas) and the insignificant surface areas occupied by thermal barrier coatings.

The results of computer simulation of the flow and heat transfer in the cooling system of the burner devices under consideration are given. It has been established, in particular, that the presence and spatial localization of protective coatings on the outer surface of stabilizers has a negligible effect on the intensity of heat transfer from the inner surface of the stabilizer wall to the refrigerant.

Conclusions. Based on the CFD simulation, a comparative analysis of the thermal state of the flame stabilizers of microjet burners with different spatial localization of thermal barrier coatings on their outer surface is performed. The regularities of the influence of the load of the boiler on the temperature regime of stabilizers with protective coatings are established. Recommendations on the application of the proposed burner devices of increased reliability are given.