

Calculation of the operation parameters of the catalytic converters of the harmful gas impurities

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In this paper theoretically grounded principles of catalytic converters design for harmful gas emissions purification of various thermal power units.

Experimental studies have shown that the smallest aerodynamic losses in structure of gas converters achieved using airfoils as working elements. This was the basis for use of the geometric structure to create catalytic converters carriers.

The paper considers the catalyst support element which is in the form of a rectangular parallelepiped with a gentle curve in the direction of the main gas flow lines. Support element is an airfoil blade. Workspace converter is filled with rows of blades. Each row of blades is a grating with parallel end walls. A combustible mixture of air and gaseous impurities with known parameters (such as total temperature, total pressure, flow direction, relative mass density of the impurity) enters at the inlet of converter. The atmospheric pressure is given at outlet. It is necessary to define for each row of blades flow parameters: temperature, speed, relative to the mass density of the impurities.

The solution the problem is associated with the development of a mathematical model of heat generation in the catalytic converter.

As a result of structural analysis of dynamic processes occurring in the catalytic converter and decomposition of a complete mathematical model of a catalytic process it is found that a major influence on the process is provided by the intensity of heat release in the combustion process of carbon (soot) and carbon monoxide which are in the mixture. Thus, to describe the process of mixing a two-component gas in this case is sufficient to use the truncated equation derived from Navier-Stokes equations, by dropping the viscous and diffuse members - Euler approach with source members.

On the basis of solution of the problem the algorithm was developed and tested on the example of the flow of harmful gas emissions of incinerators in the inter-blade channels catalyst.

Analysis of the results shows that there is a uniform temperature rise in the direction of gas flow by exothermic neutralization of harmful gases contained in the stream. By the calculation the absolute temperature increment in a grid is obtained and reached 54 °C. The experimentally determined value of raising the temperature of gas during its passage inter-blade channel is 57.5 °C. Thus, a satisfactory agreement between the calculated and experimental research results is obtained.

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