Физиканың заманауи жетістіктері және іргелі физикалық білім беру

атты 7-шы Халықаралық ғылыми конференцияның

ЕҢБЕКТЕРІНІҢ ЖИНАҒЫ

Казақстан, Алматы, 3-5 қазан 2011 ж.

АЛМАТЫ 2011

INFLUENCE DEGREE OF TURBULENCE ON HEAT-AND-MASS TRANSFER IN THE COMBUSTION CHAMBER

Askarova A.S., Bolegenova S.A., Maximov V.Yu., Bekmukhamet A. Beketaeva M.T.
Al-Farabi Kazakh National University, Almaty

The urgency of the given problem and growing attention to it relate to the work of existing power plants, the creation of new combustion chambers, with increase in quantity of the polluting substances entering in atmosphere. Participation of the power enterprises in environmental contamination by products of fuel combustion, solid waste significantly, above all, power plants, solid fuel and the main source of air pollution, and soil and water[1].

Investigated object in the given work the combustion chamber of copper RK 39 the block 300 MBT, steam capacity 475 T/hour is chosen. The copper is established on Aqsw power stations (Kazakhstan). The calculation area for carrying out computational experiments and creation of a database for modeling with useful programmed in complex PREPROZ. In created files geometrical data of investigated process, initial and boundary conditions for process modeling heat-and-mass transfer in reacting streams contain.

For a conclusion the balanced ratios selected stationary control volume element or control element mass (Figure 1). It is supposed that the center of gravity of the selected item moves with the velocity of flow. This corresponds to a stationary control volume sound approach for Euler's flows. Change the value of the transport is described in a single fluid element. The transport value is determined at each point of the domain [2].

Influence of initial level of turbulence on the basic characteristics of process of burning which shown has been investigated, that change of degree of turbulence dust gas a stream essentially affects distribution of the basic characteristics of burning process in top internal space.

We according to investigating that , comparing the obtained data for concentration of CO, CO2, CH4 for two degrees of turbulence Tu=10 and Tu=5. it is possible to draw a conclusion, that increase in degree of turbulence there is a maximum hashing of a mix and the minimum emission of harmful substances in environment. So for example, on exit concentration CO at degree of turbulence Tu=10 decrease on 52 % in comparison with exit of the same substance at Tu=5 (Value CO on an exit for Tu=10-0,00933 kg/kg, For Tu=5 - 0.00611 kg/kg) [3].

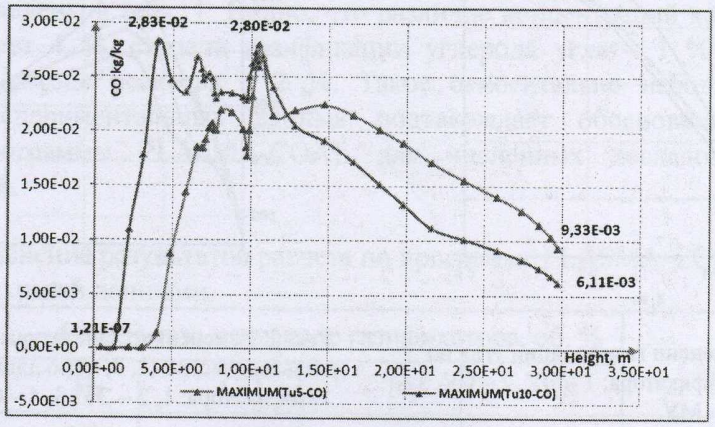

Fig.1- Comparison maximum concentration of CO along the combustion chamber for two degrees of Tu=5 and Tu=10

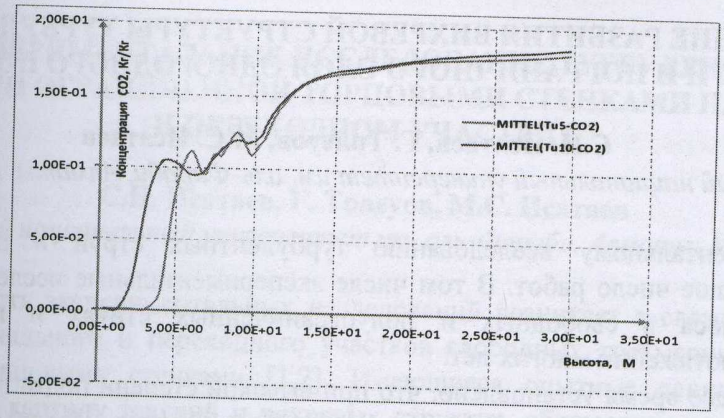

Fig.2. Concentration distribution in the combustion chamber height for the average value at Tu = 5 and at Tu = 10 for CO2

It is visible, that maxima of concentration of carbonic oxide are reached in the centre of the top internal chamber, in area where the core gasification. According to an approach measure to exit CO takes place reacts with oxygen and occurs after combustion to CO2. Concentration value CO on exit from top internal space essentially decrease.

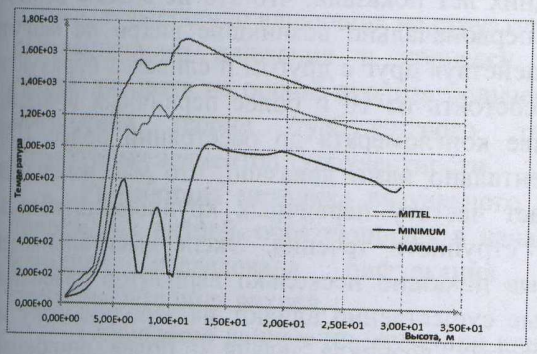

Fig.4. The temperature distribution on the height of the combustion chamber at Tu =5

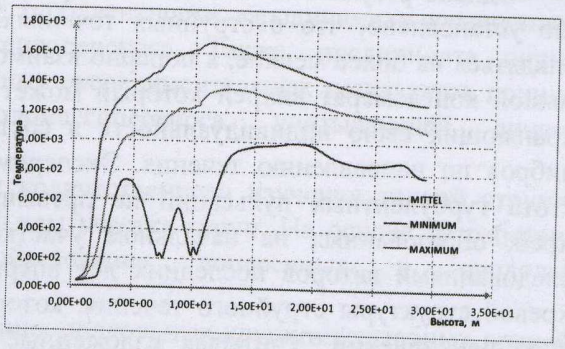

Fig.5. The temperature distribution on the height of the combustion chamber at Tu =10

From the diagram in Fig. 1-2 shows the concentration distribution of the height of the combustion chamber, depending on the gas (CO, CO2) at different values of turbulence Tu= 5 and at Tu = 10. From graphs we realized than more turbulence the less ejection harmful substances and better affects for complete combustion.

From the diagram in Fig. 3-4 distribution of temperature for various gases (CO, CO2, CH4, coke, etc.) in height in the combustion chamber differs slightly.

Reference

1. Askarova A.S., Heierle Ye., Leithner R., Müller H.CFD simulationen der NOx production in Kohlenstaub-befeuerten Brennkammern. VDI-Berichte 2056, VDI Verlag GmbH, Düsseldorf, 2009, S.575-579.

2. Askarova A.S., Lavrichsheva Y. Use of 3D-CFD tool FLOREAN to model overfire air technology in coal-fired boilers of Kazakhstan power plants. Mater. VII All-RussianConference "The burning of solid fuels", Novosibirsk, 2009, pp. 111-118

3. Askarova A.S., Lavrishcheva E., Messerle V.E., Ustimenko A.B. Simulation of plasma activated Coal Combustion in Furnace // Abstracts of 2nd International workshop and exhibition on plasma assisted combustion (IWEPAC). – Falls Church, Virginia, USA, 2006. – P.47.