INFLUENCES OF THE PHASE HEAT EXCHANGE ON PARAMETERS TWO-PHASE TURBULENT JET

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The mathematical model of a two-phase turbulent jet which may be used for calculation of two-phase jets with liquid and solid particles is developed. Testing the created model with use of the published data of an experimental investigation of the two-phase turbulent jets, shown satisfactory coordination of calculations with experiments on mean parameters and on turbulent characteristics of jet flows is carried out.

The designed mathematical model of a two-phase jet was used for examination of influence of convective heat exchange on parameters of a jet. The jets containing particles with density ρ_f from 2700 kg/m^3 up to 7800 kg/m^3 and diameter D_f from 5 mkm up to 150 mkm were considered. In initial sections of these jets in radius $r_0 = 100$ mm of velocity of gas u and particles u_f were equaled 100 м/с, temperatures of gas T and particles T_f changed from 288 K up to 1000 K, a volume concentration of particles α_f - from 10^{-5} up to $2\cdot10^{-3}$ (mass concentration of particles in view of temperature of gas changed from 0.022 up to 44.8). For a quantitative assessment of influence of heat exchange on parameters of a jet quantity was used $\overline{X}_{0.5\Delta T} = X_{0.5\Delta T.ht}/X_{0.5\Delta T.nht}$ ($X_{0.5\Delta T}$ - distance from a nozzle at which the redundant temperature of gas on an axis of a jet decreases twice in comparison with initial value; *ht* - in view of heat exchange; *nht* - without taking into account heat exchange). The quantitative data on influence of the size D_f, concentration α_f, densities of a material ρ_f and a specific heat capacity c_f of particles on parameter $\overline{X}_{0.5\Delta T}$ are received.

In particular calculations have shown, that at a volume concentration of particles $\alpha_f < 10^{-5}$ particles do not render influence on value $\overline{X}_{0.5\Delta T}$. At magnification of a volume concentration of particles from 10^{-5} up to 10^{-3} the magnification is observed $\overline{X}_{0.5\Delta T}$. In the field of concentration of particles $\alpha_f \leq 3\cdot10^{-4}$ the size of particles does not influence on $\overline{X}_{0.5\Delta T}$, and quantity of this parameter is influenced only with concentration of particles. At $\alpha_f > 3 \cdot 10^{-4}$ influence of particles concentration on $\overline{X}_{0.5\Delta T}$ increase with increase of particles diameter D_f. The increase of initial value of phases temperature results in increase $\overline{X}_{0.5\Delta T}$, and, the more the size of particles, the is stronger influence of the particles size on heat exchange in jet. From calculations follows, that for each combination α_f and D_f there is value T, since which quantity $\overline{X}_{0.5\Delta T}$ does not vary. Diminution of particles substance density at a stationary value of a specific heat capacity c_f this substance conducts to diminution of parameter $\overline{X}_{0.5\Delta T}$; with diminution D_f and c_f this influence weakens. Diminution c_f at a stationary value of particles substance density ρ_f causes diminution $\overline{X}_{0.5\Delta T}$, and with diminution D_f and ρ_f this influence weakens. On change of phases velocity and particles concentration in jet the account of heat exchange has an effect essentially to a lesser degree, than on change of phases temperature. For example, at $10^{-5} < \alpha_f < 10^{-3}$, 5 mkm $< D_f <$ 50 mkm, 2700 kg/m$^3 < \rho_f <$ 7800 kg/m^3 $\overline{X}_{0.5\Delta u}$ does not exceed 1.14, and $\overline{X}_{0.5\Delta\alpha}$ - 1.2 ($\overline{X}_{0.5\Delta u} = X_{0.5\Delta u.ht} / X_{0.5\Delta u.nht}$ and $\overline{X}_{0.5\Delta\alpha} = X_{0.5\Delta\alpha.ht} / X_{0.5\Delta\alpha.nht}$).

Operation is executed at financial support in the shape of the grant of Federal agency on formation, grant A04-3.18-11.