where the interelectrode distance is greatest. In turn the layer of deposits can result in compensation of the initial nonuniformity. Therefore the EF system can have a stationary nonuniform structure in the form of regions with different concentration of the fluidized microparticles in the interelectrode space. In the general case the dynamics of the development of the nonuniformity in the EF system, taking into account both the transverse and longitudinal instability, requires a special analysis in which the nonstationary diffusion equation is solved. However, based on the estimate made, namely, of the transverse instability of the EF system at high concentrations it is possible to explain the formation of nonuniform regions and the existence of jet flows, which were noted in [2], under conditions of electrodynamic fluidization of fine powders.

**NOTATION**

Here \( r \) is the radius of a microparticle; \( \rho \) is the density of a microparticle; \( E \) is the electric field strength; \( q_M \) is the maximum charge of a microparticle; \( \beta = 4\pi \rho^2 \) is the scattering cross section; \( m \) is the mass of a microparticle; \( g \) is the acceleration of gravity; \( n \) is the concentration; \( d \) is the interelectrode distance; and, \( s \) is the resistance of the medium per unit velocity of a microparticle.

**LITERATURE CITED**


**FLUIDIZATION OF MICROPARTICLES IN ELECTRIC FIELD**

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The results of statistical modeling of the electrodynamic fluidization of microparticles in an electric field are outlined. The dependence of the current density and charge distribution function of the microparticles on the microparticle concentration is discussed. The limiting attainable microparticle concentration in the interelectrode space is considered. The dependence of the concentration of fluidized microparticles on their bulk concentration is considered.

Electrodynamic fluidization (EDF) of conducting powders, in which microparticles of the material move in a sufficiently strong electric field, is currently of interest as a method of fluidizing disperse materials with the aim of intensifying technological processes. On account of recharging at the electrodes, the particles perform oscillations in the interelectrode space.

In the experimental investigation of this process, it is established, in particular, that there is some limiting concentration of microparticles involved in fluidization. This limiting concentration depends on the size of the microparticles, but does not depend on the magnitude of the electric field [1]. The current density of the EDF system tends to saturation with increase in microparticle concentration.

In [2], the existence of a limiting concentration was explained by the influence of gravitational forces, which lead to asymmetry of the particle distribution in the interelectrode space limiting the EDF-particle concentration. This mechanism applies for large particles (radius \( r = 100-500 \times 10^{-6} \) m).

In [3], the existence of a recombination mechanism limiting the EDF-particle concentration as a result of microparticle collisions was noted. However, only a few estimates were made.
In the present work, the possibility of statistical modeling of the motion of the microparticle system in electrodynamic fluidization in an electric field is considered, taking account of interparticle collisions; EDF is analyzed for small microparticles, in conditions where taking gravitational forces into account cannot lead to limitation of the fluidized-microparticle concentration.

Below, it is assumed that the system of EDF microparticles consists of identical spherical particles (radius $r$) with a density $\rho$. With gas filling of the interelectrode space, the resistance of the medium to microparticle motion is determined by solving the Navier–Stokes equation. In a motionless medium at small Reynolds numbers, the equation of microparticle motion takes the form [4]

$$m\dot{V} = F_E + F_g + F_d + F_n,$$

where $m = \frac{4}{3}\pi r^3 \rho$ is the particle mass; $F_E = qE$ is the force acting on a particle of charge $q$ in an electric field $E$; $F_g = mg$ is the gravitational force; $F_d = -6\pi \eta r V = -sV$ is the drag force of the medium for a microparticle of velocity $V$; $F_n$ is the term due to nonsteady motion of the microparticle. Confining attention to the case where the microparticle motion between collisions occurs at constant velocity, it follows from Eq. (1) when $V = 0$ that

$$V = \frac{qE + mg}{s}.$$

This means that $\tau_p/\tau \ll 1$, where $\tau_p = m/s$ is the time constant of the particle; $\tau$ is the mean free-flight time.

The maximum microparticle charge acquired at the electrode is determined by its radius [5]

$$q_M = 2/3\pi \varepsilon_0 \varepsilon r^2 E.$$