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Mathematical Model of Fluidized Bed Parameters

A fluidized bed is a state of a two-phase mixture of particulate solid material and fluid, which is widely used in many modern technologies for efficient implementation of various physical and chemical processes. Fluidized beds have been used in technological processes such as: cracking and reforming of hydrocarbons (oil), carbonization and gasification of coal, ore roasting, etc.

In our time, purpose and application of products from graphite is various. It explains interest to introduction and development new, and also to improvement of existing methods of its receiving from the carbonaceous materials.

Heat treatments of a carbon material is produced in a dense or fluidized bed.

The disadvantage of heat treatment in a dense layer is unevenness of heating material, and also difficulty of maintenance necessary for the process temperature in a layer, as a result quality of production decreases.

An alternative and more efficient in this context variant is the heat treatment of the feedstock in electro-thermal furnaces with fluidized layer.

Fluidized is a condition of two-phase system, characterized by the movement of solid particles relative to each other through the exchange of energy with any source. It is formed at upward movement of the fluidizing agent through a material layer, at the moment when pressure difference in a layer reaches size, sufficient for maintenance of a granular material in a suspension.

The main objective of this work was to create a mathematical model of the fluidized bed with further definition its thermal power. For this purpose two-phase model of fluidized bed was analyzed.

The model considers existence in a layer phases with various densities of firm particles: phases of the rarefied inhomogeneities (bubbles, pistons, jets) and a dense phase. Gas in each of phases may be stirred, transverse gas exchange takes place between phases. Gas flows in the phases, the ratio of the cross sections of phases, the exchange coefficients and mixing of the bed vary according to the height.

During work it was defined that the model is characterized by the following parameters: ratio of shares of particles in a dense phase and bubbles; interphase mass exchange which depends on diameter of bubbles; gas speeds in the dense and rarefied phases.

On the basis of the calculations performed, we can conclude that the parameter that most influencing the behavior of the model and, subsequently, the thermal power is the size of the bubbles.