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The Research of Heat Exchange at Electrical Heating of Carbon Material in Moving Dense Layer

Nowadays the problem of heat exchange research at electrical heating of carbon material in moving dense layer is becoming more and more important. The problem of forced convection flow and heat transfer past a continuously moving flat plate is a classical problem of fluid mechanics and has attracted considerable interest of many researchers because of its many practical applications in various processes.

Fundamental methods of heat transfer in engineering include conduction, convection, and radiation. Physical laws describe the behavior and characteristics of each of these methods

So the main task of the present work is to investigate the heat exchange at electrical heating of carbon material in moving dense layer.

The electro-thermal furnace consists of cylindrical internal shell lined with fire brick, central and side graphite electrodes.

Heating process in electro-thermal furnace goes as following: calcinated oil coke of middle size (2mm), with the temperature up to 1200 ° Celsius is submitted into the furnace. Coke gets into furnace working zone (boiling layer). Heating of the material occurs due to electric current which goes through boiling layer of the material from graphite central electrode to side electrodes. Also, nitrogen is submitted into the furnace in order to get boiling layer and increase resistance.

The peculiarities of the process are electric resistance, which depends on temperature, speed, diameter of particles and current intensity. The following dependences were revealed:

1. If the temperature increases, electric resistance decreases.
2. If the speed increases – electric resistance rises too.
3. If the diameter of particles increases – electric resistance lowers.
4. If current intensity increases – electric resistance lowers.

Moreover the peculiarity of this process is inequality (unbalance) of layer heating and the necessity of mixing the layer.

One more peculiarity of the process is the replacement of cylindrical shape to flat shape of thermal sources.

Making conclusions it is necessary to mention that theoretical and experimental heating material research, the development of recommendations as for the choice of constructions of furnace operation with continuous material movement will be developed in the nearest future.