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Improving the Efficiency of Electro-thermal Furnaces Based on Heat Recovery of the Finished Product

Electro-thermal fluidized layer furnaces are widely used abroad for graphite processing. The principle of operation of such furnaces is the conversion of electricity into heat. Electric current flows through the layer from the central electrode to the graphite lining. The main drawback of these furnaces is - the heat loss with the finished product. Graphite is characterized by a large presence of impurities, but it is a good electrical conductor, so the main task is to improve the quality of the finished product, for its subsequent use in the manufacture of batteries for electronic devices, electric vehicles, carbon products, etc.

Processing of fine disperse material such as graphite in a dense layer is not effective, so fluidized layer was chosen. It has such advantages as:

- temperature stability of the material in height and cross section;
- high rates of heat and mass transfer from the fluid layer to the surfaces of heat;
- it prolonged exposure of the particles in the layer provides deep processing of raw materials;
- a small pressure drop and its independence of the speed gas (liquid).

For efficient use of electro-thermal furnaces the technology of heat recovery of the finished product for heating raw materials was developed, which saves energy by 30-50% in comparison with known analogues. Operating processing temperature is 2000-2500 C. The treated material after electro-thermal furnace enters the cooler of the finished product, which gradually descends the temperature zones, giving its heat potential to nitrogen, which moves upward. Due to the presence of several environmental chambers in heat utilizing backflow is appeared which effectively cools the stuff. Cooled at 300 C material goes into the hopper-of- the-finished product. The heated nitrogen at a temperature of 1200 C rises on the heater channel lined with refractory materials. There is raw materials of heated to a temperature 1200 C, and then enters the electro-thermal furnace. The waste nitrogen is released to the atmosphere. There is a variant of its partial return to the cooler in order to save the loss of nitrogen.

So it is necessary to develop the mathematical model for the heat recovery furnace capacity of 1kg / h to determine the economic potential of technological solutions.