

Dmitriy Dvoretzkiy
S.S. Fedorov, research supervisor
I.P. Nikitina, language adviser
National Metallurgical Academy of Ukraine, Dnipropetrovsk

Research of Loose Material

The distinctive sign of bulk materials movement is the threat of vaulted structures during the transition into the holes of a smaller diameter. Underestimation of this phenomenon can lead to stopping of all technological processing complex.

The terms of such entities are determined by the physical properties of materials: the largest resistance to the initial landslide, grading, particle size distribution and the linear diameter of the hole, the humidity of the material.

The purpose of the study of the loose environment movement was:

-the definition of conditions of vaulted structures formation based on known empirical dependencies;

-experimental reproduction of loose material traffic conditions for connection unit of a small kiln with capacity of 10 kg/h and the cooler of the finished product.

As the research material classified anthracite was chosen.

For good bulk materials with particle size 0,5-10 mm in greatest diameter (critical) round hole that causes the formation of vaulted structures, can be determined on the basis of empirical dependencies.

Another method for calculating the critical diameter of the hole is based on the geometrical model of the consolidated structure with use of the “magnitude of the initial displacement”.

Experimental reproduction of loose material traffic conditions in unit of small kiln with capacity of 10 kg/h and the finished product cooler was carried on a special pattern.

Based on experiments, you can make the following conclusions:

- there is a small probability of consolidated structure formation in the unit that connects the small electro-thermal furnace with capacity of 10 kg/h and a cooler of cold product with diameter of 20 mm.;

- the risk of consolidated structure formation enhanced for bulk materials with non-uniform composition, the size of the largest fraction ≥ 5 mm and with increasing distance from the bottom of the furnace to the receiving bunker from 200 to 500 mm and more;

- Consolidated structure for multi-fractional material of 0,8-5 mm is easily destroyed. Due to natural vibrating load in the space of a small kiln (electro-dynamic and mechanical impact) it may not be any consolidated structures formed. But we recommend predicting vibratory device in the design of the cooler with a diameter of 20 mm.