CALCULATION AND PHYSICAL EXPERIMENTS TO DETERMINE THE MELTING TIME OF PARTICLES IN A BUBBLED MELT

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Abstract: Basalt is the most acceptable raw material for producing environmentally friendly and, what is the most important, inexpensive products. In Russia, there is an increasing interest in products based on basalt fibers due to the rapid development of construction. At the moment, more than 300 deposits of basalt rocks have been discovered on the territory of Russia. However, along with numerous advantages, there are also a number of problems that hinder the development of production facilities for processing igneous rocks into continuous basalt fiber such as maintaining the constancy of the temperature and chemical composition of the melt. The task of reducing energy costs for obtaining continuous basalt fibers is also relevant. The article presents the advantages of basalt raw materials for the production of thermal insulation material and analyzes its advantages in comparison with other materials. Based on the physical experiment, the calculation method of basalt melting and further research with its help are presented. Model experiments are conducted to calculate the real dimensions of the device. The operation and advantages of the basalt melting reactor developed at the Department of High-Temperature Energy Technology of National Research University "MPEI" are described and presented.

Keywords: melting; basalt fiber; reactor; bubbling; energy efficiency

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Figure Captions

Figure 1 Schematic diagram of a promising basalt melting reactor: *1* — regenerative preheater of initial material (RPIM); *2* — heated basalt; *3* — shaft providing rotation of RPIM feed; *4* — perforated preheater feed made in the form of a screw; *5* — bubbler layer of melt; *6* — perforated feed for organization of diffuse purging; *7* — separate supply device for gas and oxidizer; *8* — perforated roof for arranging the dispersed supply of oxidizer for afterburning; *9* — oxidizer supply; *10* — inclined pod; *11* — device for melt heating; *12* — technological window for pumping light nonbasalt fractions; *13* — partition which separates melting part of the reactor; *14* — raising pipe of melt clarification chamber; *15* — lowering pipe of melt clarification chamber; *16* — clarification chamber; *17* — technological hole to create a depression in the clarification chamber; *18* — device for heating the clarification chamber; *19* — partition separating the clarified melt from the unclarified melt; *20* — bottom plug for basalt melt release at aggregate shutdown; *21* — nozzle feeder; *22* — lubricant application mechanism; and *23* — continuous filament winding device on reels

Figure 2 Plexiglass installation

Figure 3 Graphs plotted on average values: *1* — inlet gas temperature; *2* — temperature of the melt in the barbotage zone; *3* — gas temperature above the melt; and *4* — melting time of a particle

Table Caption

Results of the physical experiment

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