AN ANALYSIS OF THE EFFICIENCY GAINED WITH REPLACEMENT OF THE TRADITIONAL LINING OF BELL AND CHAMBER METALLURGICAL FURNACES BY LINING MADE OF REFRACTORY CERAMIC FIBER

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In theory, there exist two methods of replacement of traditional lining made of fireclay insulation articles by lining made of OKB Cerablanket refractory ceramic fiber. The first method consists in production of lining made of OKB Cerablanket rolled material with the material being formed in undulating fashion into sections with height of a wave equal to the thickness of the lining. In the second method, the lining is fabricated from ready-made modular Z-blok sections with integrated anchors made of stainless steel. Sections fabricated from OKB Cerablanket rolled material is arranged in a linear or checkerboard arrangement. The operating life of lining fabricated from refractory fiber is practically unlimited. A number of conditions that guarantee long and effective service of the materials must be fulfilled, for example, the furnace temperature must not exceed 1170°C, rate of gas flow must not be greater than 20 – 30 m/sec, and the lining must not be subjected to mechanical loads.

Keywords: lining, refractory, heat-insulation material, temperature, heat flux

There exist basically two methods of replacement of traditional lining consisting of fireclay heat-insulation articles by lining made of OKB Cerablanket refractory ceramic fiber.

First Method

The lining is applied to the furnace of a metallurgical firm from rolled material fabricated by OKB Cerablanket, the material formed in undulating fashion into sections with height of each wave equal to the thickness of the lining. In this variant the lining of the crown is fabricated with a thickness of 300 mm. The roll is cut lengthwise with respect to the thickness of the crown, and then arranged in pairs and installed in the crown in rows. After four rows have been installed, the material is compacted manually or mechanically attached to the furnace jacket by means of a welded joint of stainless steel. The anchors are located along the edge of the crown 250 – 300 mm apart. Another four rows of material are then fitted on the mounted anchor. Further packing of the lining of the crown is realized in similar fashion. After the last row has been installed and mounted in the jacket, material that was left over when the rolls had been cut lengthwise is fit into the resulting gap. The flowchart of the process of lining a furnace crown is shown in Fig. 1.

The lining of the walls is created in the required design thickness. A packed “accordion” of sections fabricated from fiber 610 mm in height with thickness equal to the thickness of the lining is installed vertically. The first section is made shortened, from four waves of material with height of a wave equal to the thickness of the lining. To make the assembly process easier, the sections are constricted by means of cord or tape. Following installation a module is compressed either by hand or mechanically and then attached by means of a welded connection to the jacket by means of two anchors made of stainless steel. A section consisting of eight waves is next attached to the previously installed anchor mounting. The remaining roll is trimmed and a similar modular section is formed from it. Further packing of the lining of the walls of the heating unit along the perimeter is realized in this way. After the last module has been mounted in the row and secured in the jacket, material that has remained following preparation of the sections is inserted into the resulting gap. A strip of OKB Cerablanket material 25 mm in thickness with width equal to the width of the lining and length equal...
to the length of the roll is unrolled into the already installed row of sections. Strips are created by “cutting up” the wound roll using a knife with a fine tooth. The strip is compressed by being nipped.

Assembly and installation of the next row of sections is then carried out. The required number of rows of modular lining with filler consisting of strips of OKB Cerablanket material is thus assembled. The remaining space is lined in the following way. Sections are fabricated in the manner just described and cut apart along the edge into sections of the required dimension and already sections are compacted and secured in the jacket by means of an anchor of stainless steel. A schematic diagram of the lining of the walls is shown in Fig. 2.

Lining of the walls in the zone in which burners are located begins with the front wall. A roll is cut lengthwise along the edge of the furnace, and similarly for the lining of the crown, and then combined in pairs and installed on the furnace bottom in rows. After four rows have been installed, the material is compacted by hand or mechanically and attached by a welded connection to the jacket by means of stainless steel anchors. Four more rows of material are set on the welded anchors. Next, the wall is lined in the following way. Sections are fabricated from the roll and cut along the edge into sections of required dimensions and the installed sections are compacted and attached to the jacket by means of a lateral anchor made of stainless steel.

Lining of the walls commences with installation of the burner stone. Installation of lining made of fiber is realized according to the same principle as that of the lining of the front wall. In particular, the lining must be applied between the burner stones. Here it is first necessary to install vertical strips of material to assure a dense lining and prevent inflow of air, and then tightly fit the lining in rows of materials. A schematic diagram of the lining of walls with burners is shown in Fig. 3.

Second Method

The lining is produced from prefabricated modular Z-Blok sections with integrated anchor made of stainless steel. Sections produced from rolled OKB Cerablanket mate-