USE OF IGNITION LAYER IN PRODUCTION OF SINTERED FLY ASH AGGREGATE

Veronika Kalová

Summary

Required optimal content of combustible components ranges from 7 to 9 % of weight of material charge for the technology of processing of sintered fly ash aggregate. Coal mullock always has significantly higher content of combustible components (about 20-40 %).

Ignition layer of small fraction of crushed coal mullock is laid on the surface of the material charge; the thickness is about 2 cm. The usage of ignition layer allows to use the high content of combustible components of coal mullock for shorten the time of material charge ignition. Another positive effect is decreasing of consumption of gas needed for ignition of material charge.

The goal of this work is to prove, that the suitable usage of ignition layer of coal mullock shortens the ignition time from 4 minutes to 3 minutes at least.

Keywords: Ignition layer, coal mullock, sintered fly ash aggregate

1 Introduction

The classical technology of processing of sintered fly ash aggregate doesn't use the ignition layer. The raw material charge is laid on agglomerating grate and its surface is free. The surface is ignited by the system of gas-burners. The speed of agglomerating grate movement is suited to the time needed for perfect ignition of the surface of raw material charge. In ordinary working conditions the time needed for ignition is 4 minutes.

This classical way of ignition has a certain disadvantage. The layer of raw material charge leaving the space under the gas burner is then cooled down immediately by the surrounding air. The temperature shock usually results in bad burning of the surface of raw material charge. This layer of the thickness of about 2 cm then goes to the waste.

There is another way of ignition of raw material charge. The technological system Corson from USA uses opposite process of burning. Raw material charge is ignited by compressive gas burner placed on the bottom surface of the raw material charge. The air needed for the burning is then pressed up and the burning zone goes from the bottom to the

upper surface of the raw material charge. The temperature shock after leaving the igniting space is little bit lower. But there is still layer of the thickness of about 1 cm that goes to the waste.

New technology of processing of sintered fly ash aggregate is going to use the ignition layer of small fraction of crushed coal mullock laid on the surface of the material charge; the thickness of the layer is about 2 cm. At first the ignition layer is ignited by gas burner, it flames and burns and then it ignites the raw material charge of aggregate. This paper will prove that the usage of the ignition layer of coal mullock reduces the amount of gas needed for ignition of raw material charge. Another advantage of this way of ignition should be the positive influence on quality of burning of the raw material charge surface.

2 Properties of input raw materials

Tab. 1 Coal mullock from hard coal – coal mine OKD

Sample of coal mullock		Absorptivity [% of weight]	Moisture w [% of weight]	Weight-shortage after annealing [% of weight]
Prime sample	fraction 0-8 mm	2,78	1,46	17,05
	fraction 4-8 mm	2,68	1,89	23,79
	fraction 8-16 mm	3,56	1,18	16,06
	fraction 16-22 mm	3,06	0,94	26,73
Average sample		-	-	21,14

Tab. 2 Coal mullock from brown coal – coal conditioning plant Komořany

Sample of coal mullock	Absorptivity [% of weight]	Moisture w [% of weight]	Weight-shortage after annealing [% of weight]
Sample with high content of coal component	22,19	10,07	76,05
Sample with high content of clay component	27,46	15,86	15,02
Average sample	-	-	37,06

Tab. 3 Coal mullock from brown coal – coal conditioning plant Ledvice

Sample of coal mullock	Absorptivity [% of weight]	Moisture w [% of weight]	Weight-shortage after annealing [% of weight]
Sample with high content of coal component	24,78	13,05	54,19
Sample with high content of clay component	29,56	21,64	13,61
Average sample	-	-	33,10

Fig. 1 Crushed coal mullock from brown coal – coal conditioning plant Ledvice

3 Properties of ignition layers

Tab. 4 Coal mullock from hard coal OKD

Properties of ignition layer	Unit	Sample number		
		1	2	3
Weight-shortage after drying	%	3,14	2,85	16,81
Moisture w	%	3,24	2,93	20,48
Weight-shortage after annealing	%	18,52	21,12	35,50
Weight – in bulk	kg/m3	1175	1049	1074
Weight – shaking	kg/m3	1355	1225	1254

Tab. 5 Coal mullock from brown coal Komořany

Properties of ignition layer	Unit	Sample number		
		1	2	3
Weight-shortage after drying	%	12,20	11,64	23,83
Moisture w	%	13,98	13,46	31,31
Weight-shortage after annealing	%	36,12	37,06	51,4
Weight – in bulk	kg/m^3	996	770	798
Weight – shaking	kg/m^3	1107	887	926

Tab. 6 Coal mullock from brown coal Ledvice

Properties of ignition layer	Unit	Sample number		
		1	2	3
Weight-shortage after drying	%	9,42	9,57	21,37
Moisture w	%	10,40	10,59	27,18
Weight-shortage after annealing	%	35,54	34,65	49,76
Weight – in bulk	kg/m^3	861	746	765
Weight – shaking	kg/m^3	972	838	914

Explanatory text:
sample number 1 – fraction 0-2 mm,
sample number 2 – fraction 2-8 mm,
sample number 3 – fraction 2-8 mm (70 %) with addition of coal slurry (30 %).

4 Technology of ignition layer usage

Fig. 2 Burning of the raw material charge with gas burner

Fig. 3 Burned aggregate right under the ignition layer

Realized experimental burnings proved that coal mullock both of hard and brown coals are available for usage as an ignition layer. Coal mullock of brown coal is little bit better because of higher content of combustible components. The best results were achieved with the ignition layer containing coal mullock and also small content of coal slurry.

It was also proved that the time needed for perfect ignition of raw material charge surface was shorten from 4 to 3 minutes. The quality of burning of surface was higher because it was protected by the ignition layer, therefore it didn't cool down so quickly. [1]

5 Conclusions

The goal of this paper was to prove the usage of ignition layer containing small fraction of crushed coal mullock laid on the surface of the raw material charge. Experimental burnings proved that the usage of ignition layer is very available and allows shortening the time of material charge ignition. Another positive effect is decreasing of consumption of gas needed for ignition of raw material charge therefore it can bring a significant decrease of production costs.

The usage of coal mullock for processing of sintered fly ash aggregate is also advantageous in light of ecology. Practical usage of this waste material spares space and costs on the waste disposal.

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References

[1] ŠIFTA, J. *The usage of coal mullock for processing of artificial aggregate.* Brno University of Technology, Faculty of Civil Engineering, Brno 2006.

Ing. Veronika Kalová
✉ Brno University of Technology
Faculty of Civil Engineering
Institute of Technology of Building Materials
Veveří 95
602 00 Brno, Czech Republic
☎ +420 724 511 480
🗐 +420 541 147 502
☺ kalova.v@fce.vutbr.cz
URL www.fce.vutbr.cz