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Investigation of Repressed Burden Sintering Process

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Granulometric composition of repressed sinter burden and sintering process are studied in the paper. It is shown that repressing of sinter burden prior to supply in the pelletizing drum results in the increase of gas permeability of charge bank, reduction of content of offgrade fractions -5 mm in finished sinter, increase of iron content and also will enable to reduce amount of emissions of aeroactive fractions in slurries and atmosphere.

Keywords: REPRESSING, SINTER BURDEN, GRANULOMETRIC COMPOSITION, SINTERING, PELLETIZING

Introduction

Agglomeration sintering by air seeping from top to down through the batch layer is a principal method of ferruginous raw materials sintering for blast-furnace process. Sintering process depends on carbon combustion rate in the batch layer and velocity of combustion front from its surface to furnace grate which are defined by amount of oxygen supplied to combustion zone. When preparing the charge it is necessary to keep high gas permeability saved in the process of sintering [1].

Theoretical grounds and sintering mixture preparation to repressing sintering [2] are developed at Kryvyy Rih Metallurgical Department of National Metallurgical Academy of Ukraine. The distinctive feature of this sintering mixture preparation method is a crosscut repressing of sintering mixture prior to its supply in pelletizing drum carried out due to reduction of layer thickness of blended and moistened charge supplied by a band conveyor at interaction of balance piston (with conveyer belt) with wavy surfaced pressing roll [3]. Considering the fact that the key operation of sintering process is charge sintering, it is necessary to carry out comprehensive analysis including not only modeling of charge preparation process but also resulting process that covers efficiency of the whole flow diagram - sintering.

Results and Discussion

We used sinter burden produced at JSC “Arselor Mittal Kryvyy Rih” taken before supply in the pelletizing drum in present research. At the first stage of investigation we carried out modeling of sinter burden cross-cut repressing process on the laboratory model (**Figure 1**) which consists of charging hopper 1, conveyor 2, represser 3, receiving hopper 4. Comparative analysis of granulometric composition of repressed and

Table 1. Granulometric composition of sinter burden

Fraction, mm	Content, %			
	Prior to pelletizing drum		Pelletized sinter burden	
	Ordinary	Repressed	Ordinary	Repressed
0…-0.4	70.4	5.42	9.16	7.02
+0.4…-1	11.7	8.79	38.9	10.62
+1…-3	4.2	37.52	18.15	36.13
+3…-5	4.1	10.29	8.35	10.32
+5…-10	6.8	21.98	14.88	20.63
+10	2.8	16.01	10.55	15.28
	Average particle diameter, mm			
–	1.26	4.48	3.16	4.3

ordinary sinter burden (prepared according to current acting flow diagram) (**Table 1**) is carried out for estimation of efficiency of charge preparation process.

It follows from **Table 1** that sinter burden repressing prior to supply in the pelletizing drum enables to aggregate 92 % of dust fraction 0-0.4 mm and 20 % of intermediate fraction 0.4-1 mm in strong enough lumps with diameter from 1 to 10 mm (not less than 7 kPa). Obtained strength allows using them as pelletizing nuclei.

Granulometric composition of the charge is stabilized due to partial fracture of fractions 1-3 mm; 5-10 mm; more than 10 mm with the formation of fraction from 1 to 5 mm during pelletizing. Thus, material repressing reduces the content of fraction 0-1 mm by 30.42 % and raises an average diameter of particles in 1.36 times as compared to traditional method of charge preparation.

The comparative estimation of sintering process is carried out in the laboratory bowl (**Figure 2**) which is a welded structure composed of bowl 1 in the form of flattened cone with handles 2. Perforated plate 4 is in the bottom of the bowl. The bowl is fastened to air duct by collet 5.

Laboratory-scale plant (**Figure 3**) helped model the sintering process.

The temperature of exhaust air and rarefaction under perforated plate is controlled during sintering process. The results are shown in **Figure 4**.

Figure 1. Laboratory-scale plant of sinter burden repressing**:** *1* - charging hopper; *2* - conveyor; *3* - represser; *4* - receiving hopper

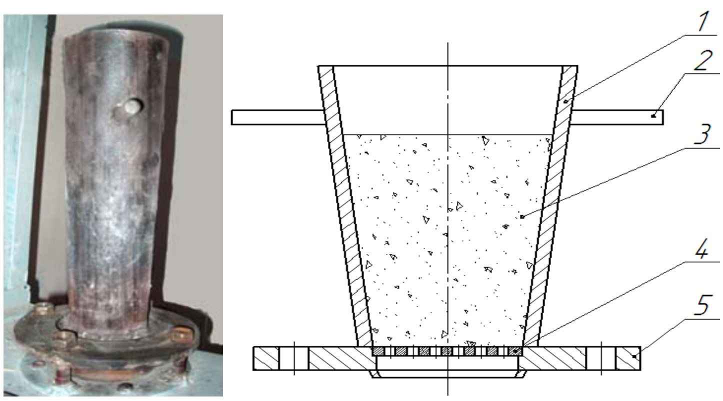

Figure 2. Laboratory bowl: *1* - bowl; *2* - handle; *3* - charge; *4* - perforated plate; *5* - collet

Figure 3. Laboratory-scale plant of sinter burden sintering

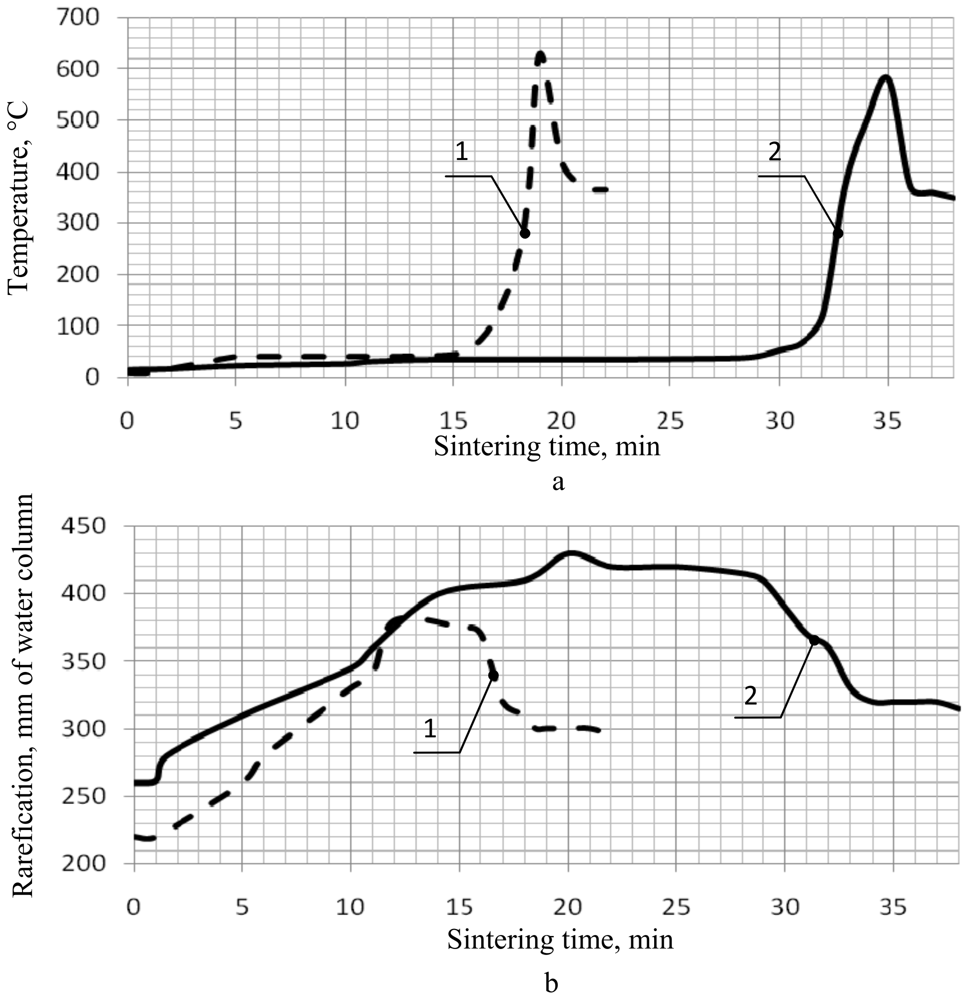

Figure 4. Graphs of behavior: *a* - temperature; *b* - rarefaction; *1* – repressed sinter; *2* – ordinary sinter

Table 2. Results of burden sintering

Parameter	Unit of measure	Burden	
		ordinary	repressed
Mass of test charge	kg	3	3
Layer height	mm	300	340
Sintering time	min	35	19
Maximum temperature	°C	580	630
Rarefaction during sintering	mm w.g.	430	380
Agglomerate weight	kg	2.1	2.275
Content of fraction 0…-5 mm in the agglomerate	g	380	350
Mass of collected dust	g	2.3015	1.8632

Results of burden sintering are resulted in **Table 2** from which it follows that sintering time of repressed burden is 1.84 times less than the similar period of ordinary charge sintering, thus material course in the bowl is higher by 13 % than in the bowl with ordinary charge. The sintering temperature of repressed burden increased by 9 %, rarefaction and dust loss decreased as compared to ordinary charge by 12 and 19 %, respectively. The content of fraction 0 …-5 mm in sinter obtained from repressed charge reduced by 7.89 %.

Conclusions

Results of investigation show that repressing of sinter burden prior to supply in the pelletizing drum results in the increase of gas permeability of charge bank, reduction of content of offgrade fractions -5 mm in finished sinter, increase of iron content and also will enable to reduce amount of emissions of aeroactive fractions in slurries and atmosphere.

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Исследование процесса спекания агломерационной шихты, подготовленной подпрессовкой

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В статье приведены исследования гранулометрического состава аглошихты, подготовленной подпрессовкой, а также процесса ее спекания. Показано, что подпрессовка агломерационной шихты перед подачей в барабанный окомкователь способствует увеличению газопроницаемости слоя шихты, уменьшению содержания некондиционных фракций -5 мм в готовом агломерате, увеличению содержания железа, а также позволит уменьшить количество выбросов аэроактивных фракций в шламы и атмосферу.