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SINTER PRODUCTION USING BLAST FURNACE SLUDGE AND STEELMAKING SLUDGE

The results of the experiments and calculations, it is proposed the optimal ratio of the main components of the sinter mix and the maximum quantity of sludge to achieve maximum productivity of sinter machine and sinter quality. Ill. 2., Tabl. 1., Bibl. 3 names.

Keywords: sinter production, pelletizing, sintering, sludge, productivity of sinter machine, sinter quality

Introduction

Disposal of sludge from the agglomeration of iron ore materials is one of the most economical ways to increase efficiency and reduce the cost of the agglomerate. Complexity in terms of preparation charge materials is the use of impounded metallurgical sludge [1]. During an extended stay in warehouses sludge caked their surface dries. The result is solid sludge granules, which are not destroyed by the entire production line preparation sinter mix and get on pallets sintering machines where broken sintering technology [2].

Statement of the problem and the state of the question

Modern technology agglomeration placing increased demands on the quality of the preparation of sintered materials. Involvement in the sphere of agglomeration of iron waste, including sludge impounded, complicates the technology of preparation and mixing conditions and pelletizing sinter mix. Well mixed particles of the same size, moisture and mold. Therefore, homogenization of the sinter mix and the subsequent formation of granules in drums-pelletizers will depend on the degree of uniformity of particle size and chemical compositions of the mixture components [3].

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The main results of research

To investigate the influence of sludge - converter and blast performance on the sintering process, as well as the strength of the finished sinter, in vitro studies were conducted.

Preparation of charge materials were analyzed as follows. Mixing was carried out in batch pallet by layering materials between layers, followed by stirring to obtain a homogeneous mass of the charge.

Sintering was conducted on pelletized batch laboratory sinter plant. Loading is done by hand, observing the uniformity and homogeneity of the material in the layer stacking bed of 200 g of the return fraction of 5-10 mm. Sintered layer height - 300 mm. The vacuum in the vacuum chamber at the time of ignition - 500mm. w. c. Art. Ignition duration - 1 min. Ignition temperature - 1200 ° C. During sintering, every 30 seconds. fixed vacuum and temperature in a vacuum chamber. Sintering is conducted to a maximum temperature in a vacuum chamber. Weight sinter cake was weighed, and then determined the yield of agglomerate (mass and percentage of fraction 10 mm to the weight of the cake).

Next were calculated vertical speed sintering according to the formula:

$$Vs. = H / ts., \text{ mm / min} \quad (1)$$

where h - height of the mixture layer, mm; ts. - Sintering time, min

and plant capacity by the formula:

$$C. = (G * 60) / (1000 * ts. * F), \text{ m / m * h} \quad (2)$$

where G - yield agglomerate kg; f - area sintering mI.

Test finished sinter strength was performed by the standard method - sieving samples of suitable agglomerate mass of 1.5 kg after 4 drop sequence in copra into fractions 0-5 mm, 5-10 mm and 10 mm.

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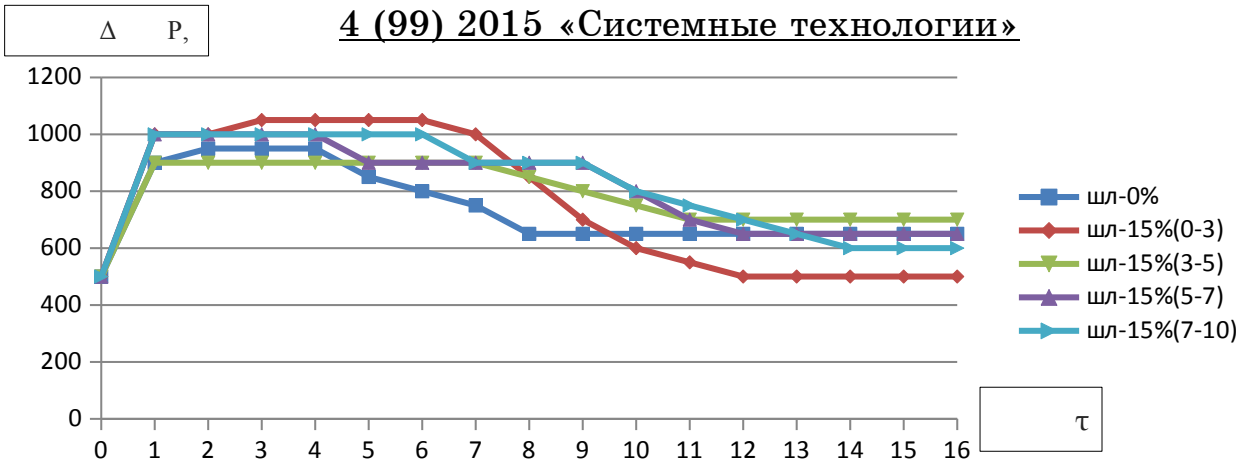

Figure 1. Diagram of vacuum in the vacuum chamber during the sintering process

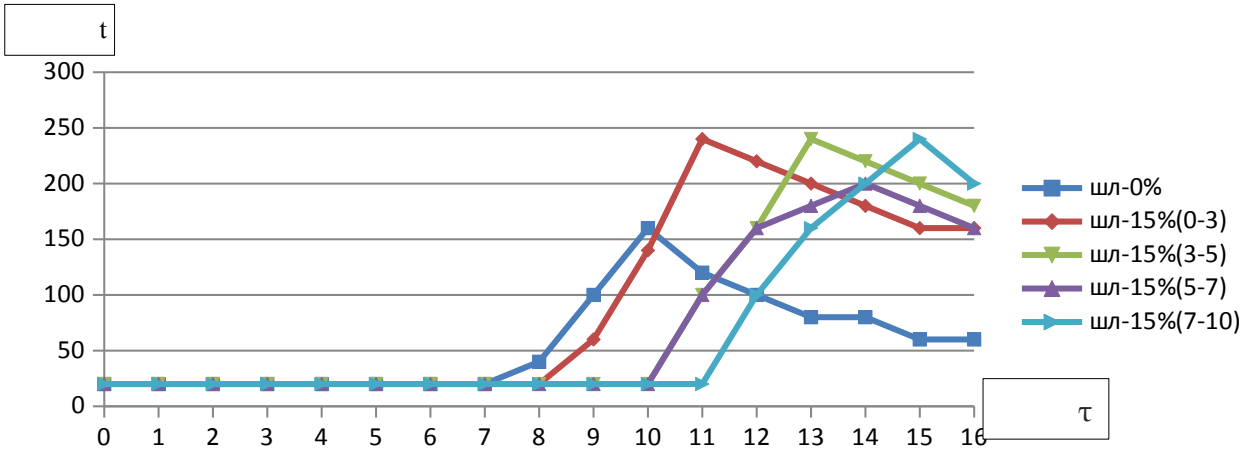

Figure 2. Diagram of the flue gas temperature during sintering

Discussion of experimental results

As seen from the experimental results, the introduction of the sludge sinter mix adversely affects the performance and durability of the finished sinter mix machine agglomerate. Although a significant portion of the iron oxides, fuel and fluxing agents, which has a positive effect on the sintering process, sludge introduced into sinter mix many harmful impurities, which limits their use in the blast furnace process. Furthermore, the use of sludge degrades sinter mix thermal characteristics because of their lower thermal conductivity (~ 1,20 Ч 10-5 mI / s (because the mixing ratio of blast furnace and BOF sludge ~ 50/50 ~ 1.08 Xsl. Ч 10-5 mI / s; Xsl. ~ 1,32 Ч 10-5 mI / s; Xsl. = (1,08 Ч 10-5 + 1,32 Ч 10-5) / 2 = 1 20 Ч 10-5 mI / s) compared with sinter mix not containing sludge, ~ 1,75 Ч 10-5 mI / s) and a higher specific heat (~ 925 J / kg (~ 980 sl. J. / kg; sl. ~ 870 J / kg sl.

= (980 + 870) / 2 = 925 J / kg) compared with sinter mix not containing sludge ~ 693 J / kg).

The deterioration of thermal performance sinter mix (reduction of thermal conductivity, specific heat increase) when administered in its composition of sludge, due also to the decrease in performance and durability of the finished sinter mix machine agglomerate with increasing fraction introduced sludge as sludge granules have considerable strength, which allows them to not be destroyed in the process pelletizing, and this leads to the fact that during the sintering process they take on a substantial part of the thermal energy, and wherein the residence time of the pellets in close sinter mix machine sludge is still not sufficient for complete sintering, which adversely affects the performance and durability sinter mix machine finished sinter. Therefore, we can conclude that the optimal fraction of sludge for use in the sintering process, leading to minimal performance loss and strength - 0-3 mm, a larger fraction is recommended to grind.

However, entering into the sinter mix sludge fines has one major drawback, which, however, is offset by an increase in productivity of the sinter plant and the strength of the finished sinter. As seen in Figure 1, with a decrease in size of insertion of sludge, the gas permeability of the charge column decreases (when incorporated in sinter mix sludge fraction 0-3 mm, the vacuum in the vacuum chamber reaches 1050 mm. w. c., and has remained at this level throughout most of the sintering time - right up to the moment of raising the temperature of exhaust gases, when incorporated in sinter mix sludge fraction 3-5 mm, high vacuum in the vacuum chamber is maintained just prior to the growth temperature of exhaust gases, but its maximum value reaches only 900 mm. w. c., when incorporated in sinter mix sludge fraction 5-7 mm, maximum vacuum slightly higher - 950 mm.w. c., however since the 4th minute sintering is gradually reduced, if introduced into the sludge sinter mix fraction of 7-10 mm,

maximum depression is even higher - 1000 mm.w.c., reduction begins at 6 minutes, sintering, but by the end of sintering it reaches a low point, as the best indicators of permeability showed sinter mix without adding sludge - the maximum value of about 950 mm. w. c., starting from the 4th minute sintering, there is a stable tendency to reduce the vacuum in a vacuum chamber). This is due to hit a significant amount of charge fines in sinter mix machine that fills the space between the space between the pieces granules of charge materials, which makes it difficult passage of gases through the column of the sinter mix.

But the dependence of the maximum flue gas temperature during sintering of the size entered in the sinter mix sludge is not installed.

Findings

1. Comparison of the thermophysical properties of the sinter mix and the mixture of sludge and domain converter productions revealed that the latter have a lower thermal diffusivity and higher specific heat capacity, which leads to a slower heating of the sludge granules. Unsintered part of the larger granules of sludge is the reason for the reduction of gas permeability post sinter mix and reduce the strength of the finished sinter.

2. Reduced fraction introduced into the sinter mix slurries adversely affect the permeability of the charge column, but the performance of the sintering plant and increases strength of the final agglomerate. This is explained by the lower thermal diffusivity and higher specific heat capacity of the sludge granules, compared to the sinter mix, and high strength, which leads to increased costs of thermal energy insufficient preheating, and consequently, the defective large sintered pellets of sludge, so the optimum sludge fraction, introduced into the sinter mix - 0-3 mm larger fraction is recommended to grind.

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3. Dependence of the maximum temperature of the gases in the vacuum chamber during the sintering of the faction made to the sinter mix sludge is not installed.

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