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# DEVELOPMENT OF PRESENTATIONS ABOUT THERMAL FACTORS OF SINTERING PROCESS

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The analysis of heating engineering descriptions of sintering process for ore raw material is executed. The results of development of new thermal factors of sintering process, qualificatory intensity of its flowing and having influence on quality of the prepared product are presented.

Keywords: sintering process, thermal factors, intensity, heating engineering descriptions, carbon

*Introduction.* From heating engineering positions agglomeration of ore raw material sintering layer of sintering mixture is by a very effective technological process, as at the comparatively insignificant mass part of combustible carbon in a sintering charge at the production of iron-ore agglomerate and manganese agglomerate - achievement is provided in the area of forming of agglomerate of temperature within the limits of 1250-1500 °C.

*Basic part of researches.* By heating engineering descriptions of sintering process it is necessary to consider its parameters, which determine the temperature-thermal level of process, providing the making of durable cake directly base heating engineering description, heating engineering descriptions of tits process, it is thus necessary to consider the specific expense of hard fuel (carbon) on the production of agglomerate. However the indicated base heating engineering description of process of agglomeration allows only implication to estimate the expense of warmth on the production of agglomerate. By the generalized heating engineering description of process of agglomeration, giving the estimation of its thermal necessity, there can be a specific expense of warmth on the production of agglomerate of $q_m$, Joul/kg.

For determination of specific warmth of combustion of carbon in sintering mixture it is possible to take formula:

$$c_m = \frac{c_{CO_2} + n \cdot c_{CO}}{1+n} \ , \qquad (1)$$

where $\tilde{n}_{\tilde{N}O_2}$, $\tilde{n}_{\tilde{N}O}$ – thermal effects of burning of carbon to $CO_2$ and $CO$ respectively, Joul/kg; $n$ – a relation $CO/CO_2$ in products of burning of carbon, part. unit.

For the estimation of intensity of sintering process from fuel-energe position two heating engineering factors were before offered [1]:

– intensity of burning of the hard fuel $I_m$ (or carbon, if in composition sintering mixture there are other components, containing a combustible carbon, $I_c$) contained in a charge, kg/(m$^2$·s), equal to work of the specific productivity of sintering process on the suitable agglomerate $q$, kg/(m$^2$·s) on the specific expense of hard fuel (or carbon respectively) on the production of agglomerate $T$, kg/kg;

– a thermal factor of intensity of sintering $G$, Joul/(m$^2$·s), equal to work of intensity of burning of hard fuel on the specific warmth of its combustion $c_m$, Joul/kg; which it is necessary to name intensity of heat generation in the area of burning.

Contradictory character of influence of intensity of sintering on durability of products of sintering production (cake and prepared agglomerate) is explained as follows [2]. At treatment of cake, abandoning a sintering machine, the destroying loading does not provide the proper estimation of its durability, therefore the exit of suitable agglomerate from cake is determined by factors, positively influencing on durability of cake and increasing with the increase of intensity of sintering. Main from these factors is an increase of temperature in a burning zone. At treatment of suitable agglomerate, got during separating from cake of all before appearing change, the considerable destroying loading in the revolved drum allow more objectively to estimate strength descriptions of agglomerate, which get worse at the increase of intensity of sintering.

If to express intensity of burning of carbon through the rate of climb of cake, determined on a specific sintering gas make, then the calculation formula of such description will look like:

$$I_{Ó} = w_0 \cdot \frac{C_{ø}}{V_{ã}} \ , \qquad (2)$$

where $w_0$ – speed of filtration of gas in a sintering layer, m/s; $V_{ã}$ – a specific sintering gas make, m$^3$/kg of dry charge.

Intensity of burning of carbon can be expressed by the specific productivity of sintering machine on the suitable agglomerate $q_{ã}$, kg/(m$^2$·s). Then calculation formula for Iy it is possible to write down as:

$$I_{Ó} = q_{ã} \cdot \frac{C_{ø}}{k_{ã}} \ . \qquad (3)$$

Formulas (4) and (5) allow to do an important conclusion that at the normal and enhanceable expense of fuel in a charge the specific productivity of sintering machine and rate of climb of cake is not only straight proportional to intensity of burning of fuel but also back proportional to the mass part of hard fuel in a charge.

Calculations on the brought formulas over showed that in the conditions of industrial sintering plants value of intensity of burning of $I_c$ and intensities of heat generation $G$, change within the limits of 30.7-80.2 kg/(m$^2$·hour) and 570.6-1789.3 MJoul/(m$^2$·hour) respectively.

For the estimation of efficiency of the use of warmth in a sintering process and its thermal mode it is expedient to enter another heating engineering description – fuel thermal tension of areas of forming of agglomerate $Q$, Joul/(m$^3$·s), which determines the quantity of warmth which is distinguished as a result of burning of fuel in unit of volume of tits area in time unit. Tits' heating engineering description is got, dividing intensity of heat generation on the height of area of burning, $h$:

$$Q = \frac{G}{h} \ / \qquad (4)$$

For the typical conditions of sintering industrial iron-ore mixture the medium-altitude of area of burning according to the brought formula over makes 15-21 mm. It is necessary from here, that fuel thermal tension of area of burning is areas of forming of agglomerate can be within the limits 7.548-33.135 MJoul/($m^3$·s). So considerable vibrations of heating engineering description of major technological area of process of agglomeration render substantial influence on properties of the prepared agglomerate and foremost on its mechanical durability and recovered.

Calculation and comparison of колебаемости in relation to an average, given above for the same sintering plants, values of intensity of burning of fuel of sintering mixture, intensities of calorification in the area of burning and fuel thermal tension of area of burning shows, that it consistently increases among $I_c$, $G$, $Q$ and makes according to 0.83, 1.16, 1.26 respectively. It goes to show that as far as strengthening of specification of thermal terms of flowing of process of agglomeration of oscillation of corresponding descriptions of process increases.

*Conclusions.* The executed researches show that the thermal factors of sintering process can be divided into two basic groups. To the first group the specific charges of fuel (carbon) and warmth behave on the production of agglomerate. The second group is presented by intensities of burning of fuel (carbon) of sintering mixture and calorification in the area of burning, and also by fuel thermal tension of tits zone for machine.

## REFRECTORES


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