UDC 669.162.1:622.785

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DEVELOPMENT OF SIMULATION MODEL AND ESTIMATION OF PRACTICAL REALIZABILITY OF SAC BY PELLETIZING PROCESS FOR CHARGE MATERIALS IN DRUM PELLETIZERS

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The simulation model of pelletizing process of charge materials in pelletizers of drum type is worked out. The estimation of practical reliability of SAC by a foregoing process is executed. It is set that the use of worked out SAC in drum pelletizers allows the pelletizing process for charge materials to reduce the quantity of recover of the mentioned materials on 5.2 %.

Keywords: charge material, pelletizing process, drum pelletizer, simulation model, SAC, estimation of its reliability

The mathematical model of pelletizing process for charge materials must adequately to characterize all its basic features and properties which show up in the conditions of the real functioning and co-operating with an external environment. Attempts of creation of such model [1-3] were based on description of motion for charge materials on a drum pelletizer, offered V. Korotich [4]. However such the motions of iron-ore materials is the difficult enough phenomenon mathematical description of which contains many ambiguous moments, and also there are not contain in an obvious kind analytical correlations, relating the entry and output parameters of process, that does not allow to use its for the imitation of control system by the pelletizing process.

The state of dynamic balance (the state at which quantity initial and finished factions remains permanent usually coming at passing by charge material area of pelletizer with long 6-7 m) is characterized by equation:

$$K_{1\Sigma} \cdot M_1' = K_{2\Sigma} \cdot M_2' \, , \tag{1}$$

where M_1', M_2' – a quantity of initial and finished faction in a state of dynamic balance respectively.

Coefficients $K_{1\Sigma}$ and $K_{2\Sigma}$ it is possible to write down

$$K_{1\Sigma} = \frac{2M_{2\Sigma}' \cdot (M_1 - M_1')}{\tau_p \cdot (M_1 \cdot M_{2\Sigma}' + M_1' \cdot M_{2\Sigma})}; \tag{2}$$

$$K_{2\Sigma} = K_{1\Sigma} \cdot \frac{M_1'}{M_{2\Sigma}'} \tag{3}$$

It is set that dependences $K_{1\Sigma}$ and $K_{2\Sigma}$ on the angle of slope of pelletizer and speed of its rotation has character, near to linear; and dependences of the mentioned coefficients on humidity W – point of contrary. Therefore equations of dependence of coefficients from control influences it is possible to write down

$$K_{1\Sigma} = -0{,}1254 - 1{,}2912 \cdot 10^{-3}\alpha + 5{,}8196 \cdot 10^{-4} n + 0{,}0334W - 2.040 \cdot 10^{-3} W^2 \;; \qquad (4)$$

$$K_{2\Sigma} = -0{,}0474 - 5{,}610 \cdot 10^{-4}\alpha + 1{,}920 \cdot 10^{-4} n + 0{,}0127W - 7.8066 \cdot 10^{-4} W^2 \;. \qquad (5)$$

As follows from the got results, the range of variation of values of parameter M'_{3-10} for the operating system of adjusting of humidity far more than for synthesized control system. In addition, results of measuring of quantity of faction -3 mm in a pelletizing charge for operating SAA showed that a mean value $M'^{\text{3ñí}}_{-3}$ was 52.8 % [5]. The results of calculations on the simulation model of pelletizing process with the use of worked out SAC fixed a value $M'^{\text{ðî çð}}_{-3}$ = 47.6 %, id est. the presence of difference of these sizes specifies on reduction of quantity of recover of charge materials.

As is generally known [6], exactness of method of recognizing optimization is determined by the step of surplus of parameters, influencing on a process. Thus than less than its size, the more so the real technological situation in the logical-predicate model of object is adequately reflected. In the case of the use of algorithm of recognizing optimization in SAC by the pelletizing process exactness of determination of size of optimal control will be determined by the error of devices, measuring grain-size distribution of charge materials, because adjusting of other parameters (speeds of rotation and angle of slope of drum pelletizer) is carried out discretely, coming from the concrete technological conditions of production and technical descriptions of pelletizer, and the error of measuring of modern SHF-hydrometers is small [7,8]. Consequently, there is a task of search of error ΔM for measuring of grain-size distribution of charge materials, which, from one side, satisfy exactness of control pelletizing process, and, on the other hand, physically would be realized as a concrete measuring device.

A size $M'^{\max}_{3-10}$ can be found for a mathematical model with use the method of the coordinate-wise lowering [24]. The results of calculations showed that for the conditions of drum pelletizer of sintering machine No 1 OAJ «Metallurgical combine «*Zaporozhatal′*» the value of size $M'^{\max}_{3-10}$ makes 44.36 % (at the parameters of process of M_{-3} = 73.88 %; M_{3-10} = 20.28 %; M_{+10} = 5.84 %; W = 8.22 %; n = 9 min^{-1}; α = 1 hail).

Determination of value of exactness, characterizing sufficient quality of control, executed with the use of criterion Fisher F. At the level of meaningfulness 0,95 for 100 calculations the size of this criterion must not exceed 1.39. As a less value of mean-squated depurture deviation chose the size S^2 at ΔM = 1 %.

It is set that by the compromise value of size ΔM, which, from one side, satisfies necessary quality of control of pelletizing process and, with other, reflects the relative error of the real measuring device [9-11] there will be a size 3 %.

Conclusions

1. The results of the executed researches showed that vibrations of factious composition of charge materials were by a casual size, up-diffused on a normal law. The educed statistical conformities allowed to synthesize the algorithmic model of generating of revolting influences. Efficiency of control of SAC by the pelletizing process for charge materials, in the top level of which the method of recognizing

optimization is used depends on the size of error of measuring of grain-size distribution ΔM, the recommended value of which is 3.0 %. It is set that the use worked out two-tier SAC allows to reduce the quantity of recover of charge the pelletizing process for charge materials on 5.2 %.

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